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PUBLIC SERVICE COMMISSION OF WISCONSIN

Chisago Electric Transmission Line Project Environmental Impact Statement

Dockets 1515-CE-102 and 4220-CE-155

Date Issued, January 1999

PUBLIC SERVICE COMMISSION OF WISCONSIN

Chisago Electric Transmission Line Project Environmental Impact Statement

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Public Service Commission of Wisconsin
610 North Whitney Way
P.O. Box 7854
Madison, Wisconsin 53707-7854
Phone 608.266.5481 • Fax 608.266.3957 • TTY 608.267.1479
E-mail: pcsrecs@psc.state.wi.us
Home Page: http://www.psc.state.wi.us

This Environmental Impact Statement for the proposed Chisago Electric Transmission Line Project and the proposals of Northern States Power Company-Wisconsin, Northern States Power-Minnesota and Dairyland Power Cooperative to construct, operate, upgrade, and improve electric transmission lines and substations complies with the Public Service Commission's requirement under Wis. Stat. § 1.11 and Wis. Adm. Code § PSC 4.30.

By: _____ _____

Kathleen J. Zuelsdorff
WEPA Coordinator
Public Service Commission of Wisconsin

Date

Questions about information provided in this Environmental Impact Statement should be directed to:

Kathleen Zuelsdorff (Environmental)
Public Service Commission
(608) 266-2730

Or

David J. Barger (Engineering)
Public Service Commission
(608) 266-5576

To the Reader:

This Environmental Impact Statement (EIS) fulfills part of the requirements of the Wisconsin Environmental Policy Act (WEPA) Wis. Stat. § 1.11. WEPA requires state agencies to consider environmental factors when making major decisions. The purpose of this EIS is to provide the decision makers, the public, and other stakeholders with an analysis of the social, cultural, and environmental impacts that could result from the construction of the proposed transmission line and related facilities in the State of Wisconsin. This EIS was prepared by the Public Service Commission of Wisconsin (Commission) staff.

The Commission decision on the merit of this project will be based on the record of public hearings that will be held in the Trollhaugen Convention Center, 2232 100th Avenue, Dresser, Wisconsin beginning on February 8, 1999. These hearings satisfy the WEPA requirements of the Commission. The Notice of Hearing for this project was mailed on December 22, 1998. The EIS, as well as testimony from the public hearings, will be included in the hearing record. A Commission decision on the proposed project is expected in April.

The Commission will decide whether to approve, deny, or modify the project based on the information presented at the hearing. If the Commission approves the project, it will select a river crossing location and a route in Wisconsin for the proposed 230 kV Chisago – Apple River electric transmission line.

Part of this proposed project is located in Minnesota. The applicants can only begin construction if the project is approved in both states, and the approved routes meet at the state boundary (the St. Croix River). The Minnesota Environmental Quality Board (MEQB) is the state agency in Minnesota charged with making this transmission line decision. In addition, the location and design technology for crossing the St. Croix National Scenic Riverway must receive approval from the U.S. Army Corps of Engineers.

The Commission and the MEQB have been coordinating their review and public outreach activities for the past two years. The MEQB issued an Environmental Impact Assessment (EIA), which describes the potential impacts of the project in Minnesota, on September 8, 1998. Both agencies held joint public information meetings on October 12 and 13, 1998. The Minnesota process will continue separately, with decisions in Minnesota occurring in the summer of 1999. More information about the process in Minnesota can be obtained by calling John Hynes of the MEQB at (612) 296-2871.

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A

Part A - Commission Staff Contributors and Reviewers

Authors

David Barger – Author

Paul Helgeson – Author

Nancy Korda – Author

James Lepinski – Maps

Kathleen Zuelsdorff – Author

Reviewers

James Loock

David Ludwig

Barbara Pickhardt

Udaivir Sirohi

Part
B

Part B - Chisago Electric Transmission Line Project Executive Summary

The existing transmission system is stressed beyond its capabilities.

By 2002 the forecasted demand for electricity in northwestern Wisconsin and eastern Minnesota will stress the existing electric transmission system beyond its capabilities. In addition, the age, condition, and capacity of some existing transmission lines in the area will require their replacement in the near future in order to continue serving local loads. Service interruptions are possible within two to three years if improvements to the transmission system are not made. Lastly, existing constraints in the transmission system limit power transfers from west to east. Transmission improvements in this area would incidentally provide some additional transfer capability by relieving some of the constraints.

Northern States Power Company (NSP) and Dairyland Power Cooperative (DPC) have jointly proposed the Chisago Electric Transmission Line Project to meet the needs for present and future electric demands in the project area. The proposal includes:

NSP & DPC jointly proposed this project to correct the differences.

- Constructing a new 38-mile 230 kV transmission line between the Chisago County and Apple River Substations;
- Constructing a new 15-mile 115 kV transmission line between the Chisago County Substation and a new substation near Taylors Falls, Minnesota;
- Rebuilding an existing 69 kV line between the new substation and the Apple River Substation;
- Installing new equipment at the Chisago County and Apple River Substations.

This proposal extends from the Chisago Substation in Chisago County, Minnesota to the Apple River Substation near Amery, Wisconsin. An outstanding water resource, the St. Croix National Scenic Riverway, bisects the project area. Except for the communities of Taylors Falls, Minnesota and St. Croix Falls, Wisconsin, which are

located along the St. Croix River, the project area is primarily rural in nature. East of the St. Croix River valley, in Wisconsin, the landscape is mostly rolling farmland with many scattered wetlands and forest tracts. Because of numerous recreational opportunities provided by the lakes, rivers and forest resources, tourism is an important economic and social aspect of the project area.

The projected cost is between $45.5 and $55.8 million.

The estimated construction cost for the river crossing and the work in Wisconsin for the proposed Chisago Electric Transmission Line Project is between $45.4 and 55.8 million. Selection of one or more underground line designs could add up to $8 million to the project cost depending on the length of the underground section and the technology used.

Major Issues

Regulatory

Minnesota must also approve this project.

The portion of the Chisago Electric Transmission Line Project located in Wisconsin is described in this EIS. The portion of the project in Minnesota is under the jurisdiction of the MEQB and is described in its Environmental Impact Assessment. Decisions on the Minnesota portion regarding project approval, route selection including a river crossing location and line design as well as other environmental mitigation measures will be made by the MEQB in the summer of 1999. In order for the project to proceed to construction, these decisions must mesh with similar decisions made by the Commission for the portion of the project in Wisconsin. The Rural Utilities Service, a federal agency that oversees expenditures made by DPC, must also approve the project.

Concerns of several federal and state agencies must be addressed.

In addition, the concerns of several state and federal agencies responsible for protection and management of the St. Croix National Scenic Riverway and its associated resources must be adequately addressed in the decision process.

Environmental Concerns

In Wisconsin the primary environmental and socio-economic concerns identified are related to the following locations and resources:

- The St. Croix National Scenic Riverway.
- The community of St. Croix Falls, WI.
- Interstate Park and two county parks.
- The Apple River Flowage

- Extensive areas of wooded wetlands.

Three alternative river crossings have been proposed.

Three alternative locations for crossing the St. Croix River with the 230 kV line have been proposed. (The 69 kV line crossing would be rebuilt in its existing location regardless of where the 230 kV line would cross.) Two of these locations utilize corridors that contain existing utility facilities; the other alternative crossing location is in a relatively undeveloped area. Aesthetic impacts related to the presence of the proposed line and the right-of-way (ROW) clearing and construction impacts on aquatic species in the river are the major concerns at the St. Croix River.

Effects on tourism-related businesses, personal property, and community appearance are important issues associated with route alternatives that pass through the city of St. Croix Falls. The higher density of homes located along several of the proposed routes also raises concerns about EMF.

Several parks and wetlands could be affected by the proposed line.

Interstate Park lies adjacent to the St. Croix River in Minnesota and Wisconsin and is heavily used, especially by local residents and visitors from the Twin Cities metropolitan area. The park's geology, topography, and proximity to the St. Croix River make it a unique and special resource. Several of the proposed routes cross Interstate Park property, potentially affecting the aesthetic experience of park users and causing possible interference with long-range development plans for the park. Two county parks that provide hiking and cross-country ski trails are also located along one of the proposed routes.

The Apple River flowage, located in the eastern portion of the project area, is another important recreation resource in the area and also serves as a major stopover for migrating waterfowl and other birds, including the trumpeter swan, a state-endangered species. Boating and fishing are the primary recreational uses on the flowage. Many permanent and vacation residences are present along the eastern shoreline of the flowage. One of the proposed routes passes over the flowage raising concerns about potential bird-wire collisions and users' decreased use and enjoyment of the water resource.

Extensive wooded wetlands located in the eastern portion of the project area adjacent to US Highway 8 and other county roads could be greatly affected by ROW clearing that would be required if some route options are approved. Loss of forest habitat, alteration of wetland hydrology, and possible degradation of the remaining habitat are the major concerns in these areas.

Transmission Line Designs

Underground options are being considered.

Due to the potential for significant aesthetic impacts in the St. Croix National Scenic Riverway and the communities of Taylors Falls, Minnesota and St. Croix Falls, Wisconsin, a number of line designs are under consideration for some sections of the proposed transmission lines. These designs include boring the 230 kV line beneath the

river, placing the 230 kV or 69 kV line underground within residential areas in the communities, and low-profile overhead designs to keep the high-voltage line in scale with its surroundings in urban areas. Each of these designs has technical limitations and environmental risks that must be also be considered in the decision process.

Project Need

The proposed project would provide solutions for the identified needs.

The need for transmission improvements in this area is based on an extensive review, in the Wisconsin Advance Plan process, of current and future transmission problems. That analysis identified the Chisago Electric Transmission Line Project as the most cost-effective solution to provide reliable electric service to customers in northwestern Wisconsin and eastern Minnesota. An incidental benefit of the project is that it would provide some additional transfer capability into Wisconsin, but not as much as goals set by current regional transmission studies.

Part C

Part C - Project Description

On September 6, 1996, Northern States Power Company-Wisconsin (NSPW), Northern States Power Company-Minnesota (NSPM), and Dairyland Power Cooperative (DPC) jointly filed an application with the Public Service Commission of Wisconsin (Commission) for authority, under Wis. Stat. §§ 196.49 and 196.491, and Wis. Admin. Code chs. PSC 111 and 112, to construct new electric facilities. The original application proposed to construct two projects: 1) the Chisago Electric Transmission Line Project, which includes construction of a 38-mile 230 kV (230,000 volt) "Chisago-Apple River" electric transmission line from the Chisago County Substation near Stacy, Minnesota, to the Apple River Substation near Amery, Wisconsin; and 2) the Stone Lake-Bay Front Electric Transmission Line Project, which includes construction of a 161 kV "Stone Lake-Bay Front" electric transmission line in Wisconsin from the Farmers Inn Substation in Hayward to the Bay Front Substation in Ashland.

In October 1997, NSPW requested that the Commission consider the Stone Lake-Bay Front Electric Transmission Line Project as a separate project. In November 1997, the Commission granted this request and established a separate docket for the Stone Lake-Bay Front Electric Transmission Line Project (docket 4220-CE-157). After hearings in this docket, the Commission authorized the construction of the Stone Lake-Bay Front Electric Transmission Line Project on April 30, 1998.

The Commission will make a decision on the Chisago Electric Transmission Line Project proposal under dockets 4220-CE-155 and 1515-CE-102. The Chisago Electric Transmission Line Project is the subject of this Environmental Impact Statement. A map of the project, including all the alternative routes, is shown in Figure C-1.

DPC, NSPM, and NSPW state that the Chisago Electric Transmission Line Project is required to maintain adequate electric service to northwestern Wisconsin and the Taylors Falls area of east-central Minnesota. They propose to maintain customer service reliability by building new electric transmission facilities to meet the growing electric energy needs of these areas. The proposal would require construction of the transmission lines, substations, and associated facilities described as the following:

- Construct a new 38-mile 230 kV transmission line between the Chisago County Substation near Stacy, Minnesota, and the Apple River Substation near Amery, Wisconsin;
- Construct a new Lawrence Creek Substation near Taylors Falls, Minnesota;
- Construct a new 15-mile 115 kV transmission line between the Chisago County Substation and the new Lawrence Creek Substation;
- Rebuild the existing 69 kV transmission line between the proposed Lawrence Creek Substation and the Apple River Substation;
- Install a new 345/230 kV transformer and 230 kV substation at the Chisago County Substation;
- Install a new 230/161 kV transformer and 230 kV substation at the Apple River Substation.

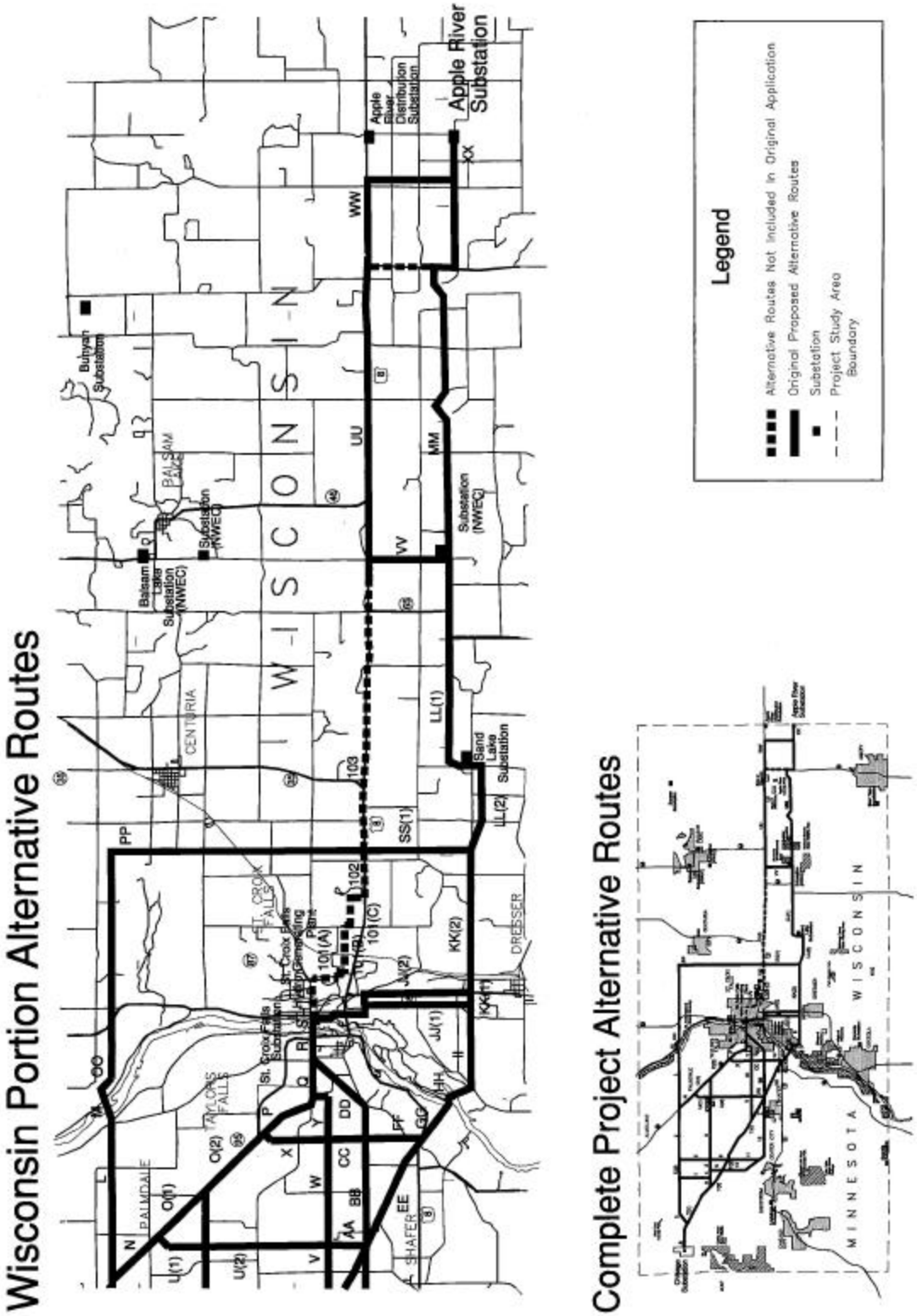
Chisago Project Costs

The total estimated cost for this project ranges from $45,434,000 to $55,798,000. This includes the cost of constructing the new Lawrence Creek Substation, cost of additions at Chisago and Apple River Substations, all costs of building the proposed transmission lines in Minnesota and Wisconsin, and the cost of a St. Croix River crossing. The ten million dollar range is the result of an approximate six million dollar difference between the lowest and highest cost options for the river crossing and four million dollar range in cost of alternative Wisconsin routes. Route 4 in Minnesota was assumed (an average cost route) and the applicants' cost estimates for the three substations were used.

Table C-2 Estimated Project Costs

	Low	High
Chisago Substation		$9,501,000
Line in Minnesota (Route 4)		$8,485,000
Lawrence Creek Substation		$6,610,000
River Crossing	$ 165,000	$6,662,000
Wisconsin Routes	$13,128,000	$16,995,000
Apple River Substation		$7,545,000
Total	**$45,434,000**	**$55,798,000**

Figure C-1 Route Alternatives



Part D

Part D - Other Government Agency and Public Participation in this Project

The Public Service Commission of Wisconsin (Commission) relies on other state, federal, and local agencies to provide information on resources and land use in areas where proposed utility projects are located. The Commission also depends on the public and citizen organizations for ideas, locally known information, and feedback. Other agencies, utilities, individuals, and organizations may hire consultants to analyze specific problems for them. This section explains how the participation of these groups helps the Commission staff in its analysis.

A variety of players have had roles in the development and analysis of this project proposal:

- Several federal agencies.
- Several other Wisconsin state agencies.
- Four Minnesota state agencies.
- Local government agencies.
- Consultants who have compiled data on the need, possible line design for the project, and potential affected resources.
- Participants at public meetings and calling or writing the Commission.
- Letters and phone calls.

Many of these groups have contributed either to development of the utilities' application or to the Commission staff's analysis of the application.

Federal government agencies

Table D-1 is a list of federal government agencies and their involvement in this project.

Table D-1 Federal government agencies 'involvement in the project

Agency	Interest
National Park Service	St. Croix National Scenic Riverway
U.S. Fish and Wildlife Service	Federal Endangered and Threatened Resources
U.S. Army Corps of Engineers	Permits for construction in wetland and navigable water
Rural Utilities Service (RUS)	Oversight of DPC projects
Federal Aviation Administration	Monitor line height near airports

State government agencies

State agencies protect the interests of the citizens of Wisconsin. In some cases, an agency's role is to ensure compliance with a state law that covers part of the project. In other cases, the agency supplies information the utility might need to design the power line or Commission staff needs to analyze the utility proposal.

As a project develops, Commission staff calls on knowledgeable staff of other state agencies as questions arise. Commission staff also checks with other agencies to make sure that the information supplied by the utility on environmental impacts is accurate and timely. Table D-2 summarizes the state agency involvement in the project.

Department of Agriculture, Trade and Consumer Protection's (DATCP) Agricultural Impact Statement (AIS): Under Wis. Stat. § 32.035, DATCP is notified of any project that could involve the acquisition of farmland or an interest in farmland (easement) through the use of eminent domain (condemnation). If the project involves the acquisition of an interest in more than five acres of land from any one-farm operation in Wisconsin, the DATCP prepares an AIS. DATCP has determined that an AIS is appropriate because of the scope of this project.

The AIS is an informational and advisory document. It describes and analyzes the potential effects of this project on farm operations and agricultural resources. Its purpose is to ensure that owners of affected farm operations in Wisconsin are informed of the potential agricultural impacts as easements are negotiated. The AIS is currently being prepared and will be available at the public hearing.

Table D-2 State government agencies 'involvement in the project

Agency	Interest
Wisconsin Department of Natural Resources (DNR)	
1. Bureau of Endangered Resources (DNR-BER)	Reviews project area for endangered or threatened species and natural communities; makes recommendations for their protection.
2. Environmental Section, Northern Region (based in Spooner)	Reviews proposed project area in Polk County and also the system alternatives in Burnett County for potential natural resource impacts.
3. Interstate State Park staff	Reviews project to assess potential impacts on Interstate Park.
4. Mississippi-Lower St. Croix Rivers Team (based in Eau Claire)	Reviews project river crossings and system alternatives in St. Croix County.
Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP), Agriculture Impact Program	Reviews project area to assess scope of agricultural impacts on area farms; currently preparing an Agricultural Impact Statement.
State Historical Society of Wisconsin (SHSW), Division of Historic Preservation	Reviews project area for historic and cultural resources; identifies archeological sites and historic structures in the project area.
Wisconsin Department of Transportation (DOT), District 8, Highways Division	Reviews impacts on highways in project area.
Minnesota-Wisconsin Boundary Area Commission (based in Hudson, WI)	Monitors St. Croix National Scenic Riverway and coordinates between the states for projects at the state boundary.
Minnesota Department of Natural Resources	
1. Ecological Services Section	Provides endangered and threatened species and community information in and adjacent to the St. Croix River.
2. Environmental Section	Reviews proposed project to assess potential natural resource impacts.
Minnesota Environmental Quality Board (MEQB)	Makes a decision on transmission line routing when a line is larger than 200 kV.
Minnesota Department of Public Service (MDPS)	Hired a consultant to study the need for the transmission line and choice of the best system alternative.

Local government agencies and institutions

Local governments ensure that the route and design of a transmission line meet local standards and permitting requirements. The local government also ensures that the project conforms to local ordinances and zoning regulations. Local governments provide information regarding land use plans for their communities to utilities and Commission staff. The statutes, however, state that local governments cannot block a transmission line project through adoption of new ordinances or resolutions.

The utilities generally do not seek any local permits until after the Commission has approved a project because a number of routes or design options are often under consideration. The Commission needs to be aware of potential conflicts with local ordinances, zoning, or land use plans when approving a corridor. In many cases, local governments continue working with the utilities after the Commission approves a project to resolve concerns through changes in line design or adjustments in pole placement.

The following is a list of the local government offices that have responded to the requests for information from either the utilities or Commission staff.

- West Central Wisconsin Regional Planning Commission.
- Polk County Planning and Zoning Departments.
- Cities of Amery and St. Croix Falls, Wisconsin and Taylors Falls, Minnesota.
- Village of Balsam Lake, Wisconsin.
- Towns of Apple River, Osceola, and St. Croix Falls, Wisconsin.
- Upper St. Croix Management Commission.
- Lower St. Croix Management Commission.

These agencies have a strong interest in selecting an electric transmission line route that minimizes impacts on their community and the resources that they are charged to protect and manage. The city councils of Amery, Taylors Falls, and St. Croix Falls have passed resolutions in opposition to locating the 230 kV line in their respective cities.

The following companies were hired by the utilities or agencies to do specific work:

- Black and Veatch Engineering, Inc. prepared the River Crossing Study.
- Greystone Environmental Planners, Scientists and Engineers prepared the environmental report that is part of the project application and held consultations with the public and various local, federal, and state agencies.
- Booth & Associates prepared a report for the Minnesota Department of Public Service (DPS) and the Minnesota Environmental Quality Board (MEQB) that reviewed the need for the proposed project and the River Crossing Study, and reviewed the electric transmission system alternatives.

Intervenor financing

The Commission may compensate any organization or individual, that is not a utility, to participate in its proceedings if certain conditions are met:

- The participation is necessary to present a significant position in the case record in which the participant has a substantial interest
- There would not be an adequate presentation of that position for the case record without financial support.
- The participation would make a "significant contribution" to the record and would endure "significant financial hardship" without compensation.

The Concerned River Valley Citizens Inc. (CRVC) requested funding twice for participation in this docket. The Commission granted $3,800 to cover CRVC administrative activities and legal counsel through June 1997. In November 1997, CRVC requested $63,602 for administration, legal counsel, and to hire a consultant. The Commission denied this request in February 1998.

The city of St. Croix Falls requested $12,465 for intervenor compensation in February 1997 to participate in this docket. The Commission denied this request in June 1997 based on its policy of not funding government agencies.

Public input to the Commission

Public input contributes to the Commission staff's analysis of a project at several points:

- Written and spoken comments from public information meetings sponsored by the utilities or the Commission.
- Phone calls or written comments received during the Commission staff's review process.
- Written and oral comments on the draft EIS.
- Testimony at public hearings.

The utilities and Commission staff have held several public meetings. There have also been meetings of various government agencies to discuss social and environmental impacts. The information gathered at these meetings was used to develop this final EIS.

The Commission will hold public hearing starting February 8, 1999. Testimony received during public hearings will be included in the case record, which the Commission will use in making its decision to approve, reject, or modify the utilities' proposal. The court reporter will record the testimony presented. The hearing record will include testimony from Commission staff, utility staff, other agencies, organizations, and the public. Written comments received by the Commission or staff will not be part of the record in this case. The final EIS will be entered as an exhibit in the record. The Commission must base its decision on the hearing record. The Commission will determine whether to approve construction of the project. If the Commission does approve construction, it will determine which route, what types of poles will be used, and any other requirements which utilities must follow in building the line.

Chapter 1

Chapter 1 - The Need for ELECTRIC Transmission Improvements

Overview

Improvements to the electric transmission system in Wisconsin and Minnesota are necessary for several reasons. By 2002, forecasted customer demands for electricity will stress the existing transmission system beyond its capability to provide reliable service, and service interruptions could occur in northwestern Wisconsin and eastern Minnesota. The age, condition, and capacity of the 69 kV Lawrence Creek-St. Croix Falls-Apple River 69 kV line in Minnesota and Wisconsin require that it be replaced as soon as possible. The 34.5 kV conversion of the distribution system in eastern Minnesota that is presently in progress requires transmission improvements in Minnesota for the conversion to be effective.

Proposed transmission improvements that would solve these local load-serving problems would also incidentally increase the west-to-east transfer capability of the transmission system. This additional transfer capability could facilitate increased transactions for firm and non-firm power, and increased import capability for emergencies

1997 Wisconsin Act 204 required development of plans for new transmission lines to increase the transfer capability of the transmission system into eastern Wisconsin. Solutions to local area problems were incorporated into the plans first so that subsequent problems and options related to regional power transfers could be isolated. For this reason, a Chisago County-Apple River line was assumed in all the options. A detailed analysis of the regional options will determine, by spring 1999, which one should be built. Some information about the analysis will be available in February 1999 for the PSC public hearings for the Chisago Project.

The original and most important purpose of this proposed project is to provide reliable electric service in northwestern Wisconsin and eastern Minnesota.

Role of the Transmission System

Electrical transmission and distribution systems deliver power to customers. Transmission lines deliver power from power plants to area substations. Distribution lines deliver power from substations to customers 'homes and businesses. Substations are where transmission lines connect, or where transmission lines connect to the distribution system. Transmission lines are physically larger and of higher voltage than distribution lines. Transmission and distribution can be compared to a highway system as shown in Table 1-1.

Table 1-1 Transmission and Distribution

Transmission lines	**Are like**
230 kV 345 kV 500 kV	Interstate highways
69 kV 115 kV 138 kV 161 kV 230 kV	State highways
34 kV 46 kV 69 kV	County roads
Distribution lines	**Are like**
12 kV 24 kV	City streets and town roads
Service drop: 120/240 volts	Your driveway

1 kV equals 1 kilovolt; 1 kilovolt equals 1,000 volts

Uses of the transmission system

Good transmission system planning provides reliability (keeps the lights on) and minimizes cost (keeps the lights on inexpensively). The transmission system can deliver electricity from local sources, reduce the reserve margins, deliver power from distant available existing sources, and reduce power production costs.

When electricity was first used in Wisconsin, transmission lines connected the hydroelectric power plants on rivers to distant cities (e.g., the Prairie du Sac Plant on the Wisconsin River to Janesville and Milwaukee). As electricity use increased, new transmission lines were added over time to connect new major power plants, primarily coal plants, to new communities. Utilities built major transmission lines connecting with each other so that one utility could get power from another utility's existing power plants during emergencies instead of building redundant power plants. When customer use is not at peak levels and emergencies are not in effect, which is many hours of the year, it is also common for utilities to make use of the transmission system to buy and sell power from each other for economic reasons.

Transmission provides reliable electric service to customers

The primary use of the transmission system is to provide customers reliable service to "keep their lights on," since transmission is the critical link between power plants and distribution substations. Without transmission lines, utilities would have to generate their power from local sources which may be higher cost, instead of getting power delivered by transmission from lower cost remotely located power plants.

Transmission alleviates the need for new power plants for reserve margins

A strong transmission system is important for maintaining low reserve margins. The reserve margin is the percent calculation of how much a utility's power supply sources exceed its projected load. For a given level of reliability, a utility would need a high reserve margin (up to 30 percent more generation than load) if it were not connected to any other utilities. Instead, utilities interconnect with each other via the transmission system so they can rely on each other's power plants during power supply emergencies, thereby allowing reserve margins of 15 to 22 percent. Consequently, utilities avoid the unnecessary construction cost of expensive power plants.

Transmission is used for firm power transactions

The transmission system is used for firm power transactions. Instead of building new power plants, utilities sometimes purchase firm capacity from another utility that has existing unused power plants, and use the transmission system to deliver firm power beyond that required for local need. For this to happen, the transmission system must have sufficient transfer capability throughout the year while enduring various operating conditions. Utilities that purchase firm power from distant sources count on the transmission system to deliver electricity as reliably as a local power plant.

Transmission accommodates non-firm economy transactions

Non-firm economy power transactions are an incidental use of the transmission system that can occur when the system, built for the previous three reasons, is being underutilized. Utilities have some power plants that are expensive to operate and others that have low operating costs. During many hours of the year, utilities buy and sell non-firm economy power to each other to reduce expenses or increase sales revenues. If a transmission or generation problem arises, the economy transaction can be curtailed and the utilities resort to generating power from their own more expensive resources for their own customer loads.

FERC Order 888 recently went into effect and has caused a dramatic increase in the amount of economy non-firm transactions across the transmission system in the Midwest. During many days in 1997 and 1998, Mid-Continent Area Power Pool (MAPP) and Mid-America Interconnected Network, Inc. (MAIN) had to invoke line loading relief procedures to curtail economy non-firm transactions to prevent overload or low-voltage conditions from occurring on the electric system. MAPP and MAIN are two of the country's ten regional reliability councils of the North American Electric Reliability Council.

Transmission Planning

It is essential to plan the transmission system so that appropriate facilities are built in time to maintain reliable service to electric customers. The electric industry provides reliable electric service by setting and following standards for the electric system. Over

the years, the utilities have developed standards for power plants, transmission lines, and distribution lines. These are widely accepted standards. The Commission ensures that the utilities adhere to these standards.

Wisconsin utilities plan and build the transmission system to meet the "single-contingency" standard. When planned and built according to this standard, the transmission system will deliver electricity to customers at proper voltages even when the system is under the greatest stress (usually high use) and any single element of the transmission system, such as a line or transformer, is out of service. However, conditions may occur for which the electric system was not planned or built, so it is not possible to guarantee that customer service will be reliable 100 percent of the time.

Planning finds and solves transmission problems

Utilities plan the transmission system to anticipate problems before they happen. It can take several years to build a major transmission line. Planners use computer programs to create a model of the transmission system to simulate how the transmission system would respond to various conditions before they would actually occur. The transmission system is stressed in the model by imposing future expected peak customer loads on it. The single-contingency standard is also applied to the model, where simulations of outages of individual transmission facilities (a line or transformer) are made. The simulations identify where and when low voltage or overload problems would happen during times of stress in the future. Potential improvements to the transmission system are tested to determine if and how well they would solve the identified problems. An economic analysis and environmental assessment are performed on the electrically viable solutions. When the best solution is identified, the utility applies to the Commission for permission to construct facilities.

Types of transmission problems

Population increases translate into electricity use increases and problems

The Chisago project is needed partly because of expected growth in the use of electricity in northern and western Wisconsin. Increases in electricity use are related to increases in population or increases in use per customer (residential, commercial, or industrial). When customer electricity demands increase beyond a certain amount, the existing transmission system cannot maintain adequate voltage or avoid facility overloads during contingency conditions. Consequently, customers could have low voltage (brownouts) or service interruptions (blackouts). If a service interruption occurs, it can last for minutes, hours, or days.

Table 1-2 shows historical population and employment statistics for the counties in Wisconsin and Minnesota in the project area. The tables indicate that the project area in Wisconsin is growing moderately faster in total employment than Wisconsin is on

average. The project area in Minnesota has faster population and employment growth than Minnesota as a whole.

Table 1-2 Population and Employment in East-Central Minnesota Counties and Northwestern Wisconsin Counties

	Population		Percent Change	Employment		Percent Change
	1990	1996		1989	1996	
East-Central Minnesota Counties						
Anoka	243,641	278,531	14.3	74,758	94,392	26.3
Chisago	30,521	37,269	22.1	8,222	10,400	26.5
Isanti	25,921	29,110	12.3	6,818	8,350	22.5
Kanabec	12,802	13,815	7.9	3,434	3,945	14.9
Pine	21,264	23,323	9.7	4,736	7,257	53.2
Washington	145,896	181,741	24.6	40,194	52,605	30.9
MN Regional Subtotal	480,045	563,789	17.4	138,162	176,949	28.1
All of Minnesota	4,375,099	4,682,748	7.0	2,021,686	2,366,865	17.1
Northwestern Wisconsin Counties						
Ashland	16,307	16,650	2.1	6,669	8,155	22.3
Barron	40,750	42,114	3.3	14,584	18,793	28.9
Bayfield	14,008	14,428	3.0	2,868	3,678	28.2
Buffalo	13,584	13,660	0.6	2,898	4,313	48.8
Burnett	13,084	13,720	4.9	3,065	5,271	72.0
Chippewa	52,360	53,996	3.1	17,851	20,437	14.5
Clark	31,647	32,185	1.7	7,361	9,005	22.3
Douglas	41,758	42,256	1.2	13,412	14,606	8.9
Dunn	35,909	37,343	4.0	8,927	13,658	53.0
Eau Claire	85,183	88,668	4.1	37,090	48,850	31.7
Jackson	16,588	17,098	3.1	4,320	6,364	47.3
Pepin	7,107	7,179	1.0	1,992	2,081	4.5
Pierce	32,765	33,793	3.1	7,825	9,157	17.0
Polk	34,773	36,295	4.4	9,180	12,812	39.6
Price	15,600	16,052	2.9	5,331	6,732	26.3
Rusk	15,079	15,235	1.0	4,392	5,645	28.5
Sawyer	14,181	15,108	6.5	3,192	5,895	84.7
St. Croix	50,251	54,406	8.3	14,624	21,785	49.0
Taylor	18,901	19,247	1.8	6,542	7,885	20.5
Trempealeau	25,263	25,930	2.6	8,558	11,137	30.1
Washburn	13,772	14,414	4.7	3,666	5,248	43.2
WI Regional Subtotal	588,870	609,777	3.6	184,347	241,507	31.0
All of Wisconsin	4,891,769	5,142,999	5.1	2,104,340	2,523,219	15.7

Low voltage problems

Low voltage is a problem for electric customers because it damages motors or causes them to run inefficiently, facilities run by computer may shut down, and service interruptions may occur. Ideally, every customer's voltage should be within appropriate limits if any individual transmission facility is out of service. Sometimes, when a line trips out, customer load can be served from the remaining transmission facilities but the voltage may be too low. In that case, protective devices on the transmission system would trip out those facilities to prevent them or customer equipment from being damaged. When voltage problems are severe in magnitude or area, voltage collapse could result and a regional blackout could occur.

The types of motors affected by low voltage include those on refrigerators, furnace fans, well pumps, and ventilation equipment. Sensitive computer components in manufacturing plants or processing plants may be affected by low-voltage conditions and cause those processes to shut down. For the transmission system, voltages in the range of 90-105 percent are acceptable. When voltage is forecast to approach 90 percent, utilities plan transmission improvements. In actual operations, if voltage falls below 90 percent, utilities may interrupt customer service. A common adage in the electric industry is that no voltage (a service interruption) is preferable to low voltage (brownout) when customer or utility equipment could be damaged.

Overload problems

Each facility of the transmission system has a rated capacity. If that capacity is exceeded, the facility is "overloaded" and can fail. For a transformer, this could mean that the internal wiring heats up and breaks down insulation, which can cause an electrical short and damage the transformer. For a line, exceeding its capacity causes it to heat up too much, which can diminish some of the physical properties of its conductors (wires) or cause the line to sag lower than allowed by the electrical code.

An overloaded transmission facility is a problem for electric customers because it can lead to local or regional service interruptions. Ideally, a substation that is served by two lines could have either line alone serve the substation. However, if customer use increases beyond the capacity of either line, the outage of one line would cause the other line to trip out to avoid being damaged by an overload. With neither line energizing the substation, all the customers served from the substation would experience a service interruption.

In a transmission system where many lines and substations are connected together, facility overloads can be a serious concern. An outage of one facility can lead to the overload/outage of a second facility, which can lead to the overload/outage of a third facility, which can lead to the overload/outage of a fourth facility, etc. This situation is known as cascading outages and can cause blackouts to customers in a whole region, not just the customers of one substation.

Age and condition

As a transmission line ages it suffers wear and tear. Insulators may crack, poles may decay, and wires may be damaged by wind, ice or lightning. Lines are regularly maintained to ensure they are reliable and do not trip out of service frequently. As with many things, such as your car, the older a transmission line gets the more it costs to keep it in good operating condition. At a certain point, for economic and reliability reasons, it becomes necessary to replace the entire line instead of continuing to repair portions of it.

Distribution improvements/reconfigurations

Improvements or additions to the distribution system may also necessitate improvements to the transmission system. New distribution substations are built to serve the growing electricity demand. New substations need to be connected to transmission lines to be energized. Ideally, new transmission lines would not be necessary if the new substations were located adjacent to existing lines. However, new substations are usually located based on meeting the needs of the distribution system and can be far from existing lines.

The voltage of a distribution system in a given area may sometimes be upgraded. In the distant past, distribution systems were designed and operated at relatively low voltages (e.g. 4160 volts) for safety reasons. Improvements in technology and equipment have occurred over time to allow safe operation today at higher voltages (24.9 kV and 34.5 kV). Higher distribution voltages can eliminate distribution substations (reduce construction costs) and reduce electrical losses (reduce operating costs). Conversely, distribution voltage upgrades may require the addition of new transmission substations to provide sources for the new higher voltage. New transmission lines would be needed to connect to the new transmission substations if the substations are not adjacent to existing lines.

Transmission Problems

The transmission problems in northwestern Wisconsin and east-central Minnesota are due to a combination of the factors mentioned above. The region is divided into four geographic areas and the transmission problems in each area are described in following sections. The timing of the problems varies, with some being experienced now and others expected in the period from 2000-2002.

Western Wisconsin Study Area

Overload problems could affect customers in western Wisconsin; age and condition require the replacement of a transmission line in Wisconsin. The critical load that prompts the need for transmission improvements is 575 MW.

Table 1-3 Western Wisconsin Area Summer Peak Load Forecast (MW)

	Advance Plan 7			Advance Plan 8		
Year	Hudson	Eau Claire	Area Total	Hudson	Eau Claire	Area Total
1995	202.1	324.8	526.9	N/A	N/A	N/A
1996	205.1	329.3	534.4	N/A	N/A	N/A
1997	208.2	333.8	542.0	N/A	N/A	N/A
1998	211.3	338.4	549.7	216.1	331.2	547.3
1999	214.5	343.0	557.5	219.0	335.6	554.6
2000	217.7	347.8	565.5	221.9	340.1	562.0
2001	221.0	352.5	573.5	224.8	344.6	569.5
2002	224.3	357.4	**581.7**	227.8	349.2	**577.0**
2003	227.7	362.3	590.0	230.9	353.9	584.7
2004	231.1	367.3	598.4	233.9	358.6	592.5
2005	234.5	372.3	606.9	237.0	363.4	600.4
2006	238.1	377.4	615.5	240.2	368.2	608.4
2007	241.6	382.6	624.3	243.4	373.1	616.5
Rate	**(1.500%)**	**(1.375%)**		**(1.330%)**	**(1.333%)**	

For growth rates 0.5 percent lower, the year the 575 MW critical load occurs is 2005 (AP-7) or 2004 (AP-8); for growth rates 0.5 percent higher, the year is 2000 (AP-7 or AP-8).

Overloads

By 2002 when total area load reaches 575 MW, an outage of the King-Eau Claire-Arpin 345 kV transmission line will cause the remaining 161 kV, 115 kV, and 69 kV transmission lines between the Twin Cities and Eau Claire to be heavily loaded and potentially trip out of service. This occurred on June 11, 1997, when the outage of the 345 kV line caused near-catastrophic results for the Midwest region (see Appendix A). Also, an event occurred on June 24, 1998, when the outage of the 345 kV line, combined with other regional system disturbances, caused the electric system in the Midwest to be near total collapse (see Appendix A). Specifically, transmission system modeling shows that by 2002, the outage of the King-Eau Claire 345 kV line would cause the Red Rock-Crystal Cave 115 kV line to overload. Tables 1-5 and 1-7 list some of the communities that would be affected by a King-Eau Claire-Arpin outage.

Age and condition

The existing 69 kV line between the St. Croix Falls Substation and the Apple River Substation is 41 years old and is in poor condition. This line is important to the western and northwestern Wisconsin areas and for local communities because it delivers power into the area and because the Osceola Substation and the Sand Lake Substation are served from this line.

Northwestern Wisconsin Study Area

Low voltage and overload problems would affect customers in northwestern Wisconsin. The critical total area load that prompts the need for transmission improvements is 305 MW.

Table 1-4 Northwestern Wisconsin Area Summer Peak Load Forecast (MW)

Year	Advance Plan 7 (1.56%)
1995	272.0
1996	276.2
1997	280.6
1998	284.9
1999	289.4
2000	293.9
2001	298.5
2002	**303.1**
2003	**307.9**
2004	312.7
2005	317.5
2006	322.5
2007	327.5

For growth rate 0.5 percent lower, the year the 305 MW critical load occurs is 2006; for a growth rate 0.5 percent higher, the year is 2001.

Overload and low-voltage conditions

Based on Advance Plan 7 analyses, an outage of the Pine Lake-Apple River 161 kV transmission line causes low voltages in the Apple River area in 2002 and causes an overload on the Elk Mound-Barron 161 kV line by 2006. Outage of the Elk Mound-Barron 161 kV line will also cause low voltages in the Apple River and Barron areas by 2003.

Based on Advance Plan 8 analyses, the new Rock Creek-Hoffman 69 kV line would not be able to provide reliable service to customers of the Northwestern Wisconsin Electric Company (NWE) without other system improvements. If the ties on the

NWE system are operated normally closed, overloads would occur to the transformers at Hoffman, Balsam Lake and Frederic and portions of the Balsam Lake-Frederic 34 kV line. If the ties are opened to relieve the overloads, the Apple River-Big Sands 69 kV line will overload for an outage of either the Apple River-Barron 161 kV line or the Barron-Washco 161 kV line. It is desirable to operate the NWE system closed so that reliable service can be provided to electric customers, which requires that transmission system improvements be made as soon as possible.

East-Central Minnesota Study Area (Taylors Falls Area)

Distribution improvements would affect customers in east central Minnesota; low voltage and overload problems would affect customers in Wisconsin and Minnesota.

Distribution deficiencies and reconfigurations

The distribution system east of the Twin Cities needs to be converted to 34.5 kV, because of increasing load in the area. The existing Hugo Substation is now in the process of this conversion.

Overloads and low-voltages

An outage of any one of the 69 kV lines in the area would result in overloads or low voltages in the area by 2003, upon completion of the Chisago County-Goose Lake 115 kV line. In addition, an outage of the King-Eau Claire-Arpin 345 kV line can result in excessive flows over the Arden Hills-St. Croix Falls-Apple River 69 kV line. During such an event, the flow on the line can be reduced to acceptable levels by operating a circuit breaker at the St. Croix Falls Substation.

The reconfiguration of the distribution system to 34.5 kV and the need to avoid overloads and low-voltages, require some transmission improvements in the area. A new Lawrence Creek transmission substation is planned to be constructed near Taylors Falls; the existing Chisago County-St. Croix Falls 69 kV line would connect with the new Lawrence Creek Substation and would be upgraded to 115 kV from the Chisago Substation to the Lawrence Creek Substation. The Lawrence Creek Substation would also need a second strong source of power. The Chisago-Apple River 230 kV transmission line could serve as this second source and could be double-circuited on the same transmission structures as the 115kV line.

Northern Wisconsin Study Area

Low-voltage problems would affect customers in Wisconsin.

Low voltages

Low-voltage conditions could cause service interruptions, unless transmission improvements are made. Load growth has surpassed the capability of the electric

system in this area to "keep the lights on" when peak electricity demands occur and facilities unexpectedly trip out of service. Low-voltage conditions can occur in the area when either end of the 150-mile long Superior-Ashland-Prentice-Eau Claire 115 kV line trips out of service because customer electricity use is high. Protective devices would then trip other facilities out of service to prevent them or customer equipment from being damaged. Continued sequences of low-voltage-outages can lead to voltage collapse and a regional blackout. Since the possibility of a blackout increases when peak use occurs and the peak use in this area occurs in the winter, the loss of electricity in the cold winter months can put the health and safety of customers at risk.

Because this problem is so severe and its solution would not prejudice solutions for western Wisconsin, northwestern Wisconsin, and eastern Minnesota, NSP and DPC requested the Commission to allow them to separate this portion of the project so it could be reviewed and decided by the Commission sooner. The Commission granted the request and issued a Certificate of Public Convenience and Necessity in its order, issued April 30, 1998, to NSP to construct the Stone Lake-Bay Front 161/69 kV line along the right-of-way (ROW) of an existing 69 kV line. However, with the Stone Lake-Bay Front line built, only the near-term reliability problems are solved. Without the Chisago-Apple River line built, the long-term transmission problems (low voltages) in the northern area will arise by approximately 2004.

Specific communities affected by low voltages and outages

Depending on the situation, one community in northwestern Wisconsin may lose service or many communities could be negatively impacted because of low voltage or overload conditions. Because one facility outage may affect service to one community but another outage may lead to other outages that affect service to many communities, it is difficult to determine precisely all the communities that would lose service. The following tables identify the communities that would most likely be affected by the transmission line outages indicated. A transmission planning model was used to simulate the conditions indicated on each table.

The system was modeled and tested with normal and high transfer conditions imposed on the system. Normal transfers consist of about 700 MW of west-to-east flow, whereas high transfers are about 1,200 MW. Such transfers need to be considered in planning because the system could regularly be carrying at least 700 MW of flow for many hours of the year, and would need to be able to sustain service during an unexpected outage.

Tables 1-5 and 1-6 show the communities affected by outages, with normal transfer levels using loads projected for the year 2000. Table 1-5 is without building the proposed 230 kV Chisago-Apple River line, but does include completion of the approved Stone Lake-Bay Front 161 kV line. Most critical are the impacts of outages of the Stinson 115 kV bus and the Cornell-Holcombe 115 kV transmission line. One causes voltage collapse of the region, and the other puts many Western Study Area

communities at risk of interruption. Table 1-6 shows effects of the same outages after completion of the Chisago-Apple River 230 kV line. There would no longer be any communities at risk of interruption during single contingencies.

Tables 1-7 and 1-8 show effects of some outages under high transfer conditions. The additional power carried over the transmission system could be assumed to be non-firm economy power transactions. The higher levels of transfer cause even more communities to be at risk of outage if only the Stone Lake-Bay Front line is completed (Table 1-7). Under high transfer conditions completion of the Chisago-Apple River 230 kV line protects all communities from the risk of service interruptions (Table 1-8). There are several communities with low voltages, but none have very low voltage and none would be likely to experience service interruptions during single contingencies.

Table 1-5 Communities affected by low voltage or interruptions, with normal power transfers and without the Chisago-Apple River 230 kV line

Outage	Communities with Low Voltage [1]	Communities with Very Low Voltage with Interruptions Likely [2]
King-Eau Claire 345 kV	Range, Apple River flowage area, Haugen, Barron, Rice Lake, Pine Lake area, Hudson, N. Hudson, Burkhardt, River Falls, Martell, Spring Valley, Rock Elm, and all rural areas surrounding these communities.	None
Prairie Island-Byron 345 kV	None	None
Stinson-Dahlberg 115 kV	None	None
Cornell-Holcombe 115 kV	Range, Apple River flowage area, and all rural areas surrounding these communities.	Tony, Conrath, Sheldon, Holcombe, Donald, Hawkins, Kennan, Catawba, Prentice, Lugerville, Phillips, and all rural areas surrounding these communities.
Pine Lake-Apple River 161 kV	Range, Apple River flowage area, Haugen, Barron, Rice Lake, Shell Lake, Sarona, and all rural areas surrounding these communities.	None
Stinson 115 kV bus	**System-wide voltage collapse**	

[1] Voltage between 90% and 96% of nominal.
[2] Voltage below 90% of nominal. Customers may have service interrupted to prevent damage to customer equipment or utility facilities.

Table 1-6 Communities affected by low voltage or interruptions, with normal power transfers and with the Chisago-Apple River 230 kV line

Outage	Communities with Low Voltage [1]	Communities with Very Low Voltage with Interruptions Likely [2]
King-Eau Claire 345 kV	None	None
Prairie Island-Byron 345 kV	None	None
Stinson-Dahlberg 115 kV	None	None
Cornell-Holcombe 115 kV	None	None
Pine Lake-Apple River 161 kV	None	None
Stinson 115 kV bus	Lugerville, Phillips, all rural areas surrounding these communities	None

[1] Voltage between 90% and 96% of nominal.
[2] Voltage below 90% of nominal. Customers may have service interrupted to prevent damage to customer equipment or utility facilities.

Table 1-7 Communities affected by low voltage or interruptions, with high power transfers and without the Chisago-Apple River 230 kV line

Outage	Communities with Low Voltage [1]	Communities with Very Low Voltage with Interruptions Likely [2]
None	Pine Lake area, Range, Apple River Flowage area, Haugen, Rice Lake, Barron, and all rural areas surrounding these communities.	
King-Eau Claire 345 kV	**System-wide Voltage Collapse**	
King-Eau Claire 345 kV, with a 40 MVAR capacitor bank added at Apple River, Barron, Crystal Cave (each).	Lake St. Croix area, River Falls, Martell, Spring Valley, Rock Elm, Menomonie, Cedar Falls, Rusk, Apple River Flowage area, Barron, Phillips, Lugerville, and all rural areas surrounding these communities.	Hudson, N. Hudson, Burkhardt, Pine Lake, and all rural areas surrounding these communities.
Prairie Island-Byron 345 kV	Glenmont, Minong, Stone Lake, Northwoods Beach, Reserve, Hayward, Elk Mound, Tony, Conrath, Holcombe, Sheldon, Hawkins, Kennan, Catawba, Cornell, and all rural areas surrounding these communities	Hudson, N. Hudson, Burkhardt, Pine Lake area, River Falls, Spring Valley, Martell, Menomonie, Cedar Falls, Rusk, Rock Elm, Apple River Flowage area, Barron, Haugen, Rice Lake, Shell Lake Sarona, Park Falls, Lugerville, Phillips, Prentice, Lake Wissota area, and all rural areas surrounding these communities.

[1] Voltage between 90% and 96% of nominal.
[2] Voltage below 90% of nominal. Customers may have service interrupted to prevent damage to customer equipment or utility facilities.

Table 1-8 Communities affected by low voltage or interruptions, with high power transfers and with the Chisago-Apple River 230 kV line

Outage	Communities with Low Voltage [1]	Communities with Very Low Voltage with Interruptions Likely [2]
King-Eau Claire 345 kV	Pine Lake area, Apple River flowage area, Haugen, Barron, Rice Lake, Lugerville, Phillips, and all rural areas surrounding these communities.	None
Prairie Island-Byron 345 kV	None	None

[1] Voltage between 90% and 96% of nominal.
[2] Voltage below 90% of nominal. Customers may have service interrupted to prevent damage to customer equipment or utility facilities

Transfer capability and the Regional Transmission Study

For reliable customer service during emergency conditions, such as extraordinary generation outages or extreme electricity demands, utilities count on generation reserves of their own and on the use of generation from neighboring regions via the transmission system. For this to happen, the transmission system must have adequate transfer capability.

During summer 1997, the transmission system was stressed by the need to import substantial amounts of power from around the region when numerous nuclear generation units in eastern Wisconsin and northern Illinois were simultaneously out of service. Like other utilities in the country, utilities in Wisconsin have built generation over the years to maintain a 15–18 percent reserve margin to handle ordinary emergencies and used the transmission system to import power for extraordinary circumstances. Until 1997, it was thought that the transmission system had enough transfer capability into Wisconsin to handle extraordinary circumstances, but the experience of summer 1997 indicated otherwise.

1997 Wisconsin Act 204

1997 Wisconsin Act 204, which went into effect May 12, 1998, required the Commission to conduct a transmission study and prepare a report to the Legislature. The extraordinary events of summer 1997 were the basis for the regional transmission study, rather than a desire to improve the transmission system to purchase power from the west so as to avoid building power plants in eastern Wisconsin. The study goal was to identify interstate and intrastate transmission constraints and to identify reinforcement options to relieve these constraints.

1997 Wisconsin Act 204 created Wis. Stat. § 196.494(2), which states:

> *The commission shall conduct a study on identifying and relieving any constraint on an intrastate or interstate electric transmission system that adversely affects the reliability of transmission service provided to electric customers in this state and shall, no later than September 1, 1998, submit a report on the results of the study to the legislature in the manner provided under s. 13.172(2).*

The Regional Transmission Study of 1998

The Commission prepared the regional transmission report and sent it to the Wisconsin Legislature on September 1, 1998, as required. The report identifies transmission constraints and 12 options to improve the transmission system to increase the transfer capability into eastern Wisconsin. The study set 3,000 MW of simultaneous transfer capability into Wisconsin from adjoining regions as the goal for the options, either 2,000 MW from the west and 1,000 MW from the south, or 1,000 MW from the west and 2,000 MW from the south. This transfer capability is necessary to cover emergency conditions when generators in eastern Wisconsin may not be available, as happened in 1997 when an unusual number of nuclear power plants in the region were out of service at the same time. Achieving 3,000 MW of total transfer capability would essentially double the capability of the existing transmission system.

The report presents the results of a screening study to identify constraints based on one set of assumptions and to perform an initial evaluation of transmission options to solve those constraints. Currently, further detailed analyses are being performed to determine the optimal transmission improvements to be built to increase transfer capability into Wisconsin. Planned and potential new generation may affect how much transfer capability is needed, but it is not expected that such new generation will totally eliminate the need to increase transfer capability into Wisconsin.

The Executive Summary of the report, including a table of the "short list" of 12 options and a map of them, is included as Appendix C.

Relationship of the Chisago Project to the Regional Transmission Study

The regional transmission study is related to the Chisago Project in two ways. First, the Chisago Project was added to 11 of the 12 options for the regional study as a proxy solution for "local area" problems in northwestern Wisconsin; a proxy solution was not needed for the remaining option (Option 5a) since it would connect the Chisago County-Weston 345 kV line to the new Lawrence Creek Substation and the Apple River Substation to solve the "local area" problems. Thus, a Chisago County-Apple River line was "included" in all 12 options – in 11 options as a 230 kV line and in one option as a 345 kV line.

The initial model that was used for the regional transmission study had problems in local areas that needed solutions even before the stress of power transfers was added. By fixing the local area problems first with an assumed solution, any problems that arose thereafter would be attributed to power transfers. It is for this reason that the Chisago Project was assumed in 11 of the 12 options for the regional study. A different system alternative could have been assumed for the regional study to solve the local problems in northwestern Wisconsin instead of the Chisago Project, but at the time the Chisago Project was viewed as the most reasonable system alternative to assume.

Second, the Chisago Project would provide about 200-300 MW of the total west-to-east transfer capability. However, any of the other system alternatives (King, Rock Creek, Arrowhead) would increase the transfer capability by about the same amount as the Chisago Project. Thus, any of the system alternatives could have been substituted for the Chisago Project and not diminish or increase the 3,000 MW transfer capability goal of the regional options.

Relationship of the Chisago Project to regional power needs

The eastern Wisconsin utilities have built, and continue to build, generation to meet increasing customer electric demands so that reserve margins of 15-18 percent are maintained. They do not plan to use the transfer capability that the Chisago Project would incidentally provide to make long-term firm power purchases from generation capacity that is west or northwest of Wisconsin. Numerous power plants have been built in eastern Wisconsin recently, with more in various stages of development.

Since 1975, 25 units have been installed at 10 power plant sites, totaling 3,905 MW. These include Germantown (4 units, 1978, 75 MW each), Columbia 2 (1978, 494 MW), Pleasant Prairie (2 units, 1980 and 1985, 600 MW each), Weston 3 (1981, 334 MW), Edgewater 5 (1985, 382 MW), West Marinette (1993, 83 MW), South Fond du Lac, (4 units, 1993-1996, 85 MW each), Concord (4 units, 1993-1994, 79 MW each), Paris (4 units, 1995, 79 MW each), and LS Power -Whitewater (1997, 227 MW).

Generation capacity additions are presently in progress in eastern Wisconsin. A new power plant under construction is the De Pere Energy Center (180 MW), which received a CPCN from the PSCW in 1997 and will be in service June 1999. This plant will add 75 MW of capacity in 2004. Air inlet coolers are being added at several existing combustion turbines to provide about 100 MW of additional capacity by 1999. At this time, six proposals for new generation facilities are before the Commission seeking construction approval, totaling 953 MW, and are all expected to be in service by no later than 2000.

The public has expressed concerns that the primary purpose for the Chisago Project is to allow NSP and DPC to sell power to utilities in northern Illinois. This is not the case. The primary purpose for the Chisago Project is to provide reliable service to customers in northwestern Wisconsin and east central Minnesota. The transfer

capability that the Chisago Project would provide is an incidental benefit that would enable eastern Wisconsin utilities to count on the use of generation from neighboring regions during emergency conditions, such as extraordinary generation outages or extreme electricity demands. When not needed for reliability, utilities all over the Midwest may use available transfer capability to buy and sell power to each other to reduce costs, which is also an incidental benefit of the Chisago Project

Chapter 2

Chapter 2 - Solutions for Transmission Problems

No Action

Doing nothing is not an acceptable alternative. Using the existing transmission system, as is, will not provide adequate or reliable service. People will be at risk of service interruptions by as early as 2001 (see Chapter 1). The longer construction is delayed, the greater the risk of service outages as the growing customer demand for electricity taxes the existing transmission system. Without transmission improvements, the number and duration of service outages will increase.

Utilities are required by law to provide reliable service. As sometimes happens, however, customers may experience service interruptions when storms knock down power lines. This type of interruption is unavoidable because it is impossible to build power lines so that they are capable of withstanding the forces of nature. In contrast, increases in customer use of electricity are predictable, so utilities add facilities to the existing transmission system to prevent it from being overburdened and causing service interruptions to customers.

Some may suggest that loss of service from time to time would be tolerable, but recent experience says otherwise. In 1997, the possibility of service interruptions loomed in eastern Wisconsin because of generation outages in eastern Wisconsin and northern Illinois. Also, Wisconsin utilities could not import enough replacement power from nearby utilities via the transmission system to meet their target reserve margins because the transmission system did not have enough transfer capability. Customers of every type and size became concerned about service reliability because a service interruption was a distinct possibility, not a theoretical hypothesis. Residential, commercial, and industrial customers in eastern Wisconsin were concerned that their business, health, safety, and welfare would be at risk without electricity.

Non-Transmission Solutions

Overview

The utilities and Commission staff seriously considered ways to meet the transmission needs of northwestern Wisconsin without constructing a new transmission line. The primary reason for the Chisago Electric Transmission Line Project is because the increasing use of electricity is expected to soon surpass the capability of the area's existing transmission system to reliably serve customers. The total use of electricity in the area would have to be reduced below the present amount to eliminate the need for this project.

Some of the ways to affect the load on the transmission system include distributed generation and demand-side management. Applying these strategies system-wide can reduce the need for various transmission improvements, and targeting these strategies to a specific area (called Targeted Area Planning or TAP) can reduce the need for a specific new transmission line. Distributed generation produces electricity in a local area, which reduces the amount of power the transmission system needs to deliver into an area. This distributed generation, however, would have to be sited in the area. (The Commission's recent experience has shown the public to be equally opposed to sites chosen for generation as for transmission.) Demand-side management reduces electricity use, which also reduces the load on an area's transmission system.

The use of demand-side-management, distributed generation and TAP strategies were considered by Commission staff and utilities to see if they could be viable alternatives to the Chisago Electric Transmission Line Project. Unfortunately, for reasons described below, these measures are not viable alternatives to the proposed project.

Demand-side management

Demand-side management (DSM), applied system-wide, can reduce the need to build new power lines. DSM targeted at a specific geographic area could, in some cases, reduce the need for a specific new line. DSM consists of energy conservation, which reduces the use of electricity throughout the year, and load management, which controls the time of day when electricity is used. Past utility achievements in DSM and future projections of DSM have been reflected in the load forecasts used by NSP in the application for this project.

In Advance Plan 6 (1992), the utilities hired a consultant to do a detailed analysis of DSM potential in Wisconsin. After the technical potential for DSM was established, a reasonable portion of the total was used to adjust the load forecast. Not all the technically feasible DSM was included in this adjustment, because some technically feasible DSM is not cost-effective. This struck a compromise between including too much or too little DSM. The detailed analysis was improved and updated in Advance Plan 7 (1995). For Advance Plan 8 (1997-1998), the utilities, including NSP and DPC,

generally confirmed their earlier Advance Plan 7 forecasts by using the same (or very similar) projections of DSM and load growth.

Past DSM achievement by NSP has reduced the present loads on the transmission system. In recent years, NSP has met nearly every total company goal for energy and demand savings set by the Commission. Table 2-1 details the goals and achievement levels for NSP for the past six years. In those six years, NSP-Wisconsin reduced annual energy usage on its system by 280.1 GWH. This is roughly a one-percent reduction each year in total annual energy sales over what they would have been without NSP's conservation efforts.

Table 2-1 NSP conservation goals and achievement, 1992-1997

	1992	1993	1994	1995	1996	1997	Total
Energy Goal (GWH)	45.3	48.2	52.2	48.0	48.0	48.0	289.7
Energy Achievement	38.4	37.1	54.9	54.5	46.4	48.8	280.1
Percent of Goal	85%	77%	105%	114%	97%	102%	97%
Demand Goal (MW)	11.3	11.3	10.5	(a)	(a)	(a)	
Demand Achievement	10.9	10.4	11.2	13.6	10.6	13.2	69.9
Percent of Goal	96%	92%	107%				
Load Management (MW)	9.6	12.1	11.0	10.2	12.6	9.8	65.3

(a) The Commission stopped setting demand goals in 1995.

Table 2-1 also shows savings in system peak demand over the years 1992 to 1997. The "Demand Goal" and "Demand Achievement" reflect demand savings associated with energy conservation programs. After 1995 the Commission set only energy savings goals because utilities have enough incentive to accomplish demand reductions without the need for a mandatory goal. "Load Management" refers to programs and efforts designed specifically to reduce peak demand, such as direct load control or appliance timers. As the table shows, NSP has reduced system demand by 69.9 MW through energy conservation programs and 65.3 MW through load management programs, for a total of 135.2 MW. The total NSP-Wisconsin load is about 1,000 MW.

DSM activities are monitored and adjusted in annual or biennial rate cases of the investor-owned utilities. The Commission does not regulate DPC rates. Advance plans provide the only opportunity for the Commission to review DPC's DSM activities. Consequently, historic annual achievement information is not available for DPC and could not be included in Table 2-1.

NSP's load projections for this project assumed energy and demand reductions due to DSM in future years. NSP assumed that future DSM savings would equal those levels approved in Advance Plan 7. DPC has projected achievement levels in past advance plans. These achievement levels were based on their own analysis of DSM potential

and their own customer's expressed interest. Reports in each subsequent advance plan indicated that DPC had not met the proposed achievement levels. It is not clear what levels of conservation DPC has included in its forecast for this project. However, inclusion of the level of DSM projected by DPC in past Advance Plans would not be enough to affect the need for this line.

NSP has already, and projects to continue, reducing demand significantly by implementing DSM. Because of this, additional reductions in demand across the NSP/DPC combined systems or targeted at northwestern Wisconsin could be more difficult and more costly to achieve. For all these reasons, DSM probably could not displace this project.

Distributed generation

The use of distributed generation in northwestern Wisconsin is another way to reduce the need to use the transmission system to deliver electricity into the area. Distributed generation could consist of conventional power plants or renewable resources. Unfortunately, the cost of developing enough distributed generation, renewable resources or conventional generation in northwestern Wisconsin to match the increase in electricity use is considerably higher than the cost to build the Chisago Electric Transmission Line Project.

Conventional Generation

New generation in northwestern Wisconsin would need to support the area for as long as the Chisago Electric Transmission Line Project, and provide the same level of reliability as the project. Transmission problems arise in the area when the sum of the loads in the western subarea (Hudson and Eau Claire) and the northwestern subarea reach 876 MW in 2002. Generation solutions would have to support the area through 2010 when loads are expected to be 996 MW. If nothing were built between 2002 and 2010, the capability of the transmission system would be deficient by about 120 MW.

Generation cannot be substituted for transmission on a one-for-one basis. This is because generation has a relatively high outage rate compared to transmission. For example, a transmission line may be available to deliver power 99.966 percent of the time, whereas the availability of a combustion turbine generator ranges from 86 to 91 percent, depending on the unit size. To provide the 120 MW deficit with generation, three 130 MW units with a 93 percent availability or five 65 MW units with a 91 percent availability would be needed. Assuming an installed cost of $356/kW, the cost of the three units would be $139 million and the cost of the five units would be $116 million. This compares to the $51 million for the Chisago Electric Transmission Line Project, from the analysis of the cost of system alternatives. Also, using new generation instead of transmission to provide the needed improvement would mean that the new generation would operate at times to support the local transmission system when it would otherwise not be operated based on total system economics,

which could add millions to the cost for a generation solution. Thus, new conventional generation is not a cost-effective alternative to the project.

Renewable Resources

Renewable resources are sources of energy that are continuously replenished by natural forces and are not finite like coal, natural gas, oil, or uranium. The renewable resources of primary interest in Wisconsin are from flowing water (hydro), plant material (biomass), the wind, and the sun (solar).

Hydro - NSP and DPC have a total of 258 MW of hydroelectric nameplate capacity at 20 plants in Wisconsin, which can provide up to 269 MW of summer peak capacity. Additional hydro could be made available by: upgrading existing facilities to obtain greater capacity and efficiency, developing new hydro facilities, or developing new generation at existing dams. The cost of all three of these options is dependent on environmental evaluation, cost of mitigation measures, and the cost of re-licensing with the Federal Energy Regulatory Commission (FERC).

The only new hydroelectric capacity planned in northwestern Wisconsin is at NSP's 8.8 MW Dells Hydroelectric Plant in Eau Claire, Wisconsin. Current plans call for increasing the plant capacity to 11.6 MW by 2003, giving it an annual output of approximately 53,000,000 kWh. An application has been made to FERC for a new license, which could be granted as early as 2000. If FERC grants the license in that year, work on refurbishing and upgrading the facility will take place in 2002 and 2003.

A study done for Advance Plan 7 identified nine non-utility hydro sites that could be repowered. The total maximum potential capacity at these sites would be 7.9 MW

Biomass - Biomass energy is the energy from recently grown plant material, usually wood or energy crops. Biomass can be burned like coal to produce steam or gasified and burned like natural gas. Waste wood from the paper and forest products industries is the most cost-effective source of biomass in Wisconsin today.

In Advance Plan 8 the Commission determined that the installed capital cost of a small biomass plant, between 7.2 and 57 MW, ranged from $1640 to $3409 per kW.

NSPW currently has four units at two power plants that operate on biomass, including 30 MW of wood-fired capacity in northwest Wisconsin at its Bay Front Plant in Ashland. NSP surveyed potential biomass suppliers in its northern service territory and found that the 30 largest potential biomass suppliers in that area produce enough wood fuel to support 25.1 MW of additional biomass capacity. However, only three of these customers do not already sell or use their wood residue for other purposes.

Wind – For areas with a good wind resource (greater than 11-mph average wind speed), wind power can be the least-cost renewable energy resource. Wind power provides clean energy at a very low cost when installed, but its economic viability is

highly dependent on an adequate wind regime. Previous wind speed monitoring in northern Wisconsin has shown the area to have a generally poor wind resource. However, NSP is currently participating with other Wisconsin utilities in a three-year, statewide Wind Resource Assessment Project (WRAP). Two of the WRAP sites are in the NSP service territory, at Cornucopia and Spring Valley.

In Advance Plan 8 the Commission determined that the installed capital cost of a currently available utility grade wind power plant to be $1049 per kW.

According to currently available data, northwest Wisconsin does not have sufficient wind resources to make wind power a viable alternative power source for the area. When wind machine designs become available for lower wind speeds, this could change.

Solar - Photovoltaic (PV) systems convert sunlight directly into electrical energy. The amount of energy produced by a PV system depends upon the amount and intensity of sunlight which varies by season, time of day, and amount of cloud cover. In Advance Plan 8, the Commission staff found the cost to install a 5 MW PV system to be $4,788 per kW and O&M costs to be $10.20 per kW year. While this technology may have some niche applications, such as shaving air conditioner peak loads, it is not cost-effective compared to other types of electrical generation.

Targeted area planning (TAP)

"TAP is a planning process and analytical framework that uses detailed local information and that considers all potential resources to meet identified local energy service needs at the lowest cost and greatest benefit and with the smallest environmental footprint."--The Wisconsin TAP collaborative group.

The Description of TAP

The intent of TAP is to avoid or defer new transmission lines by meeting local area energy demands at the local level. This can reduce cost and environmental impacts because TAP supports identification and implementation of options that may have lower costs and less environmental impact. Traditional utility planning has focused on large central power plants with large-scale transmission lines used to get power to local areas. Many utility analysts are beginning to study the benefits of planning that is targeted at the local level.

TAP considers many possible alternative solutions to meet local area energy needs. These solutions include:

- Targeted demand-side management, including conservation and load management;
- Distributed generation from conventional generation, hydro, biomass, wind, or solar;

- Education to change customer use patterns.

The Wisconsin TAP collaborative group

From mid-1994 to early 1998, a group consisting of Commission staff, utility staff, and public representatives (from RENEW, Sierra Club, and Alliance for Clean Energy Systems [ACES] developed a framework to incorporate TAP into the existing regulatory process. This collaborative effort was undertaken for the following reasons: (1) the public was concerned that TAP alternatives were not being adequately or fairly considered; (2) the utilities were concerned that consideration of TAP alternatives late in the regulatory process causes delays in implementing a solution to the electrical problems that triggered the transmission project proposal; and (3) the Commission is responsible for ensuring that the least costly and least environmentally damaging alternatives are considered.

The Tap Process and Its Applicability to the Chisago Project

The TAP process developed by the TAP collaborative group consists of three steps:

- Screen all utility-planned transmission projects in the state for TAP potential, and assign a yes, no, or maybe to each project based on their relative scores.

- Perform a full-scale analysis of those projects deemed to have TAP potential to determine if local demand-side management or local distributed generation could solve the associated transmission problems.

- Implement feasible, cost-effective TAP solutions.

There are some conditions and circumstances that generally limit the ability to implement a TAP solution instead of building a new transmission line. An initial screening process that considers these and other factors is used to determine which candidate projects will receive full-scale TAP analysis.

At its April 1997 meeting, the TAP Collaborative Group screened the transmission projects for Advance Plan 7 to determine which would receive full-scale TAP analysis. The NSP projects did not have as much TAP potential as those of other utilities. The two NSP projects with the highest TAP potential were Stone Lake-Bay Front and Chisago-Apple River (the Chisago Project). The TAP Collaborative Group did not recommend a full-scale TAP study for the Chisago Project, but did recommend the full-scale TAP analysis for the Stone Lake-Bay Front project even though Stone Lake-Bay Front had a lower score. The group's reasoning was that it is difficult to find TAP solutions for such a large area and, even if TAP solutions could be found to meet the local needs, the need for west-to-east transfer capacity was expected to remain. TAP is not a resource that could stave off this need and associated transmission improvements. Table 2-2 lists the projects from Advance Plan 7 that received the full-scale TAP analysis and their scores from the screening analysis, as well as the Chisago

Project and its screening analysis score. Higher scoring projects have a greater potential for TAP analysis to find alternatives to building a line.

Table 2-2 TAP screening scores for specific Advance Plan 7 power lines

Utility/Project Name	Screening Score
WPL/Springbrook-Butternut	486
MGE/Tokay-West Towne	216
WPS/Pioneere-Crivitz	108
WE/Sussex-Duplainville	72
NSP/Chisago-Apple River (Chisago Project)	54
NSP/Stone Lake-Bay Front	32

Transmission Solutions

Overview

Planning efforts in past Advance Plan proceedings, as described in detail in Appendix A, have identified system alternatives to solve transmission problems in northwestern Wisconsin. The need for improvements in this area have changed over time – first to replace an existing aged 115 kV line, then to increase transfer capability to allow increases in economy power transactions, and presently to "keep the lights from going out" in northwestern Wisconsin. The system alternatives to address these problems, however, have basically stayed the same over time. One of those system alternatives, a reconductor/rebuild of the 115 kV line between Baldwin (WI) and Marathon City (WI) is now under construction to replace the aged 115 kV line. The rest of the system alternatives studied in Advance Plan 6 (1992) were candidates to increase west-to-east transfer capability when that was a primary objective. Similar system alternatives are now candidates to solve reliability problems expected in northwestern Wisconsin in a few years as well as provide an incidental increase in transfer capacity.

The Interface Study 3 analyzed five representative system alternatives. All five provided the needed improvements to northwestern Wisconsin but the two "Chisago" system alternatives had significantly lower costs than the others.

Thereafter, NSP and DPC performed additional economic analysis of three system alternatives. They were: Plan C (the Chisago-Apple River 161 kV line combined with the Stone Lake-Bay Front 161 kV line) and Plan D (the Chisago-Apple River-Barron-Osprey 230 kV line), and a Hybrid Plan (the Chisago-Apple River 230 kV line combined with the Stone Lake-Bay Front 161 kV). That analysis determined the cost of the Hybrid Plan to be slightly less than Plan C or Plan D. The facilities that NSP and DPC included in their application for this Chisago Electric Transmission Line Project were essentially those of the Hybrid Plan.

Commission staff revisited the economic analysis of the earlier system alternatives in its review of the utilities 'application. Commission staff determined that the Hybrid Plan (which includes a new Chisago-Apple River 230 kV line) is an appropriate system alternative to build.

The need to increase the transfer capability of the transmission system into Wisconsin for reliability reasons has become apparent recently. A transmission study, required by 1997 Wisconsin Act 204 and completed in September 1998, identified transmission constraints to importing power for reliability and options to relieve those constraints. The Chisago Project is indirectly related to some of the regional options and directly related to at least one option. Further analysis is in progress to determine which regional option should be built to increase transfer capability into Wisconsin.

Interface Study 3 analysis of system alternatives

In the early 1990s, it became apparent that load growth in northwestern Wisconsin was going to exceed what had been forecasted in the past. Without improvements, the existing transmission system would be stressed beyond its capability to provide customers with reliable electric service. The Interface Study 3, completed in 1995 for Advance Plan 7, identified five representative system alternatives (plans) to provide the needed improvements. The major transmission line facilities included in each plan are as shown in the following table:

Table 2-3 Interface transmission plans and facilities of Advance Plan 7

Plan A	Construct Arrowhead (MN)-Stone Lake-Whitetail-Arpin 230 kV line
Plan B	Convert King (MN)-Pine Lake-T Corners-Sherman Street to 161 kV Convert Red Rock (MN)-Crystal Cave to 161 kV Construct a second Pine Lake-Apple River 161 kV line Construct Stone Lake-Bay Front 161 kV line
Plan C	Construct Chisago County (MN)-Apple River 161 kV line Construct Stone Lake-Bay Front 161 kV line
Pan D	Construct Chisago County(MN)-Apple River 230 kV line Convert Apple-River 161 kV to 230 kV Construct Baron-Osprey 230 kV line Loop Rush City (MN)-Red Rock (MN) 230 kV into Chisago City Substation
Plan E	Construct Sandstone (MN)-Washco-Stone Lake-Osprey 230 kV line

All of the plans provided about 1,200 MW of west-to-east transfer capability, so this was not a factor in determining which system alternative to choose to provide reliability to northwestern Wisconsin. Since there was no difference in transfer capabilities between the plans, no cost reduction for enabling more economy transactions was attributed to any of the plans in the cost analysis.

The costs of the plans were compared on the basis of construction costs and electrical losses. The initial report, filed with the Commission in January 1995, used a range of $1/watt to $4/watt for the cost of electrical losses. An addendum to the report, filed with the Commission in August 1995, provided additional cost analysis using a refined cost of $1.50/watt for the cost of losses ($1/watt equals $1,000,000/MW). The following tables provide a summary of the August 1995 cost analysis. The two tables differ in the amount of east-to-west transfer. As the amount of transfer increases, the losses associated with the plans also increase.

Table 2-4 Economic comparison of Interface Study 3 plans ($millions) base transfers in year 2000

	Construction Cost	Loss Penalty Cost	Comparative Plan Cost	Difference with Least Cost Plan
Plan A	$111.6	$0	$111.6	+ $59.1
Plan B	$73.1	$24.0	$97.1	+ $44.6
Plan C	$33.3	$19.5	$52.8	+ $0.3
Plan D	$52.5	$0	$52.5	$0
Plan E	$64.5	$12.0	$76.5	+ $23.7

Table 2-5 Economic comparison of Interface Study 3 plans ($ millions) 1,200 MW transfers in year 2000

	Construction Cost	Loss Penalty Cost	Comparative Plan Cost	Difference with Least Cost Plan
Plan A	$111.6	$0	$111.6	+ $32.1
Plan B	$73.1	$58.5	$131.6	+ $52.1
Plan C	$33.3	$52.5	$85.8	+ $6.3
Plan D	$52.5	$27.0	$79.5	$0
Plan E	$64.5	$39.0	$103.5	+ $24.0

Based on the economic analysis, the plans that include a Chisago-Apple River line (Plans C and D) are clearly the least-cost system alternatives. The economic analysis assumed overhead construction for the entire Chisago-Apple River line. The additional cost of an underground transmission line crossing of the St. Croix River, estimated to be less than $6 million, would increase the cost of Plan C or Plan D but not enough to make other plans least cost. It is also likely that any crossing of the St. Croix would be underground, giving every plan higher costs.

In September 1995, the utilities involved in the Interface Study 3 informed the Commission that they had reached a consensus that Plan C or Plan D should proceed to construction. In its Advance Plan 7 order on interface transmission issues (issued September 1996), the Commission gave planning approval to Plan C and Plan D, but did not approve or deny the other three plans.

Further analysis of system alternatives by utilities

After the Interface Study 3 analyses, NSP and DPC performed additional economic analysis of three system alternatives. Two of these, Plan C (the Chisago-Apple River 161 kV line combined with the Stone Lake-Bay Front 161 kV line) and Plan D (the Chisago-Apple River-Barron-Osprey 230 kV line) originated in the Interface Study while the third alternative was a newly-developed hybrid plan (the Chisago-Apple River 230 kV line combined with the Stone Lake-Bay Front 161 kV). That analysis determined the cost of the Hybrid Plan to be slightly less than Plan C or Plan D.

NSP and DPC hired a consultant (Black and Veatch) to perform detailed engineering cost estimates of Plan C and Plan D. Those cost estimates were nearly twice the cost that had been estimated for Interface Study 3, causing the utilities to question the validity of the results of the economic analysis of the Interface Study 3 that indicated Plan C and Plan D as the least-cost plan. Part of the difference was because several facilities were included in the detailed estimates that were not included in past estimates. Part of the difference was also attributed to differences in unit costs between the two analyses. To resolve this question, the utilities updated the costs of several other system alternatives and compared them to the detailed engineering cost estimate of the Hybrid Plan. The other system alternatives included the Arrowhead-Arpin 230 kV option, a Sand Lake-Osprey 230 kV option, a Rock Creek-Apple River 161 kV option, and an option that converts 115 kV lines to 161 kV operation. That analysis confirmed that the Hybrid Plan was the least-cost system alternative. The details of this analysis are provided in the project application and Appendix B. A summary of the economic analysis is also provided in the following table:

Table 2-6 Economic comparison of selected Advance Plan 7 plans ($ millions)

System Alternative (Plan)	Construction Cost	Loss Penalty or (Credit)	Comparative Plan Cost	Cost Difference versus Chisago
230-161 kV Hybrid (Chisago)	$189	($28)	$161	$0
King-Hydro Lane 161 kV	$182	($10)	$172	+$11
Rock Creek-Apple River 161 kV	$177	($13)	$164	+$3
Sand Lake-Osprey 230 kV	$292	($28)	$264	+$103
Arrowhead-Arpin 230 kV	$323	($44)	$279	+$118

The voltage of the Chisago-Apple River 230 kV line is based on an economic analysis of the cost of construction and cost of electrical losses. The cost to build the line to operate as a 230 kV line, including substation equipment, would cost more than as a 161 kV line. However, the electrical losses as a 230 kV line are lower than as a 161 kV line. Overall, the lower cost of electrical losses for the 230 kV line more than offset the higher construction cost of a 230 kV line. In addition, building the Chisago-Apple River line for 230 kV provides the flexibility for future transmission needs. It is possible that those future needs may involve high-voltage transmission lines from

Minnesota to central Wisconsin, and the Chisago-Apple River 230 kV line may be part of a longer 230 kV line for that purpose.

Electrical analysis of system alternatives by PSCW staff

All the system alternatives (Chisago, Arrowhead, King, Rock Creek) solve the immediate electrical problems for northwestern Wisconsin. However, they do not perform equally well over the long term, as load growth increases. To compare the system alternatives fairly, specific facilities would need to be added to each one so that they perform the same into the future. With the electrical performance the same between system alternatives because of the added facilities, the difference between the system alternatives will be their cost. Table 2-7 shows the future facilities that would need to be added to each system alternative to make them all perform equally well until 2018.

Table 2-7 Future facilities per system alternative

System Alternative	Year Added	Facility Added
Chisago	2012	Barron-Osprey 230 kV (operated at 161 kV)
	2018	Apple River-Barron-Osprey 230 kV (161->230 conversion)
King	2011	Barron-Osprey 161 kV
	2017	Chisago-Apple River 161 kV
Rock Creek	2009	Barron-Osprey 161 kV
Arrowhead	2012	Barron-Osprey 161 kV

The cost to add these future facilities are included in the cost analysis summarized in Table 2-8.

Economic analysis of system alternatives by PSCW Staff

To ensure that the proposed Chisago-Apple River 230 kV line and the system alternative it is associated with is the least-cost, Commission staff performed an economic analysis of several system alternatives (see Figure 2-1). The factors included in the construction cost were the cost to construct new lines, the cost of future capacitor banks, and the cost of other future transmission improvements in northwestern Wisconsin. The cost of losses can vary significantly, so a range of $1.50/watt to $4.00/watt was applied. Lastly, losses change for each system alternative as east-to-west power transfers increase from base conditions to 1,200 MW, so the relative total costs also change. The following tables show how the total costs change as these factors vary. In all cases, the system alternative with the Chisago-Apple River 230 kV line is the least-cost.

Figure 2-1 System Alternatives

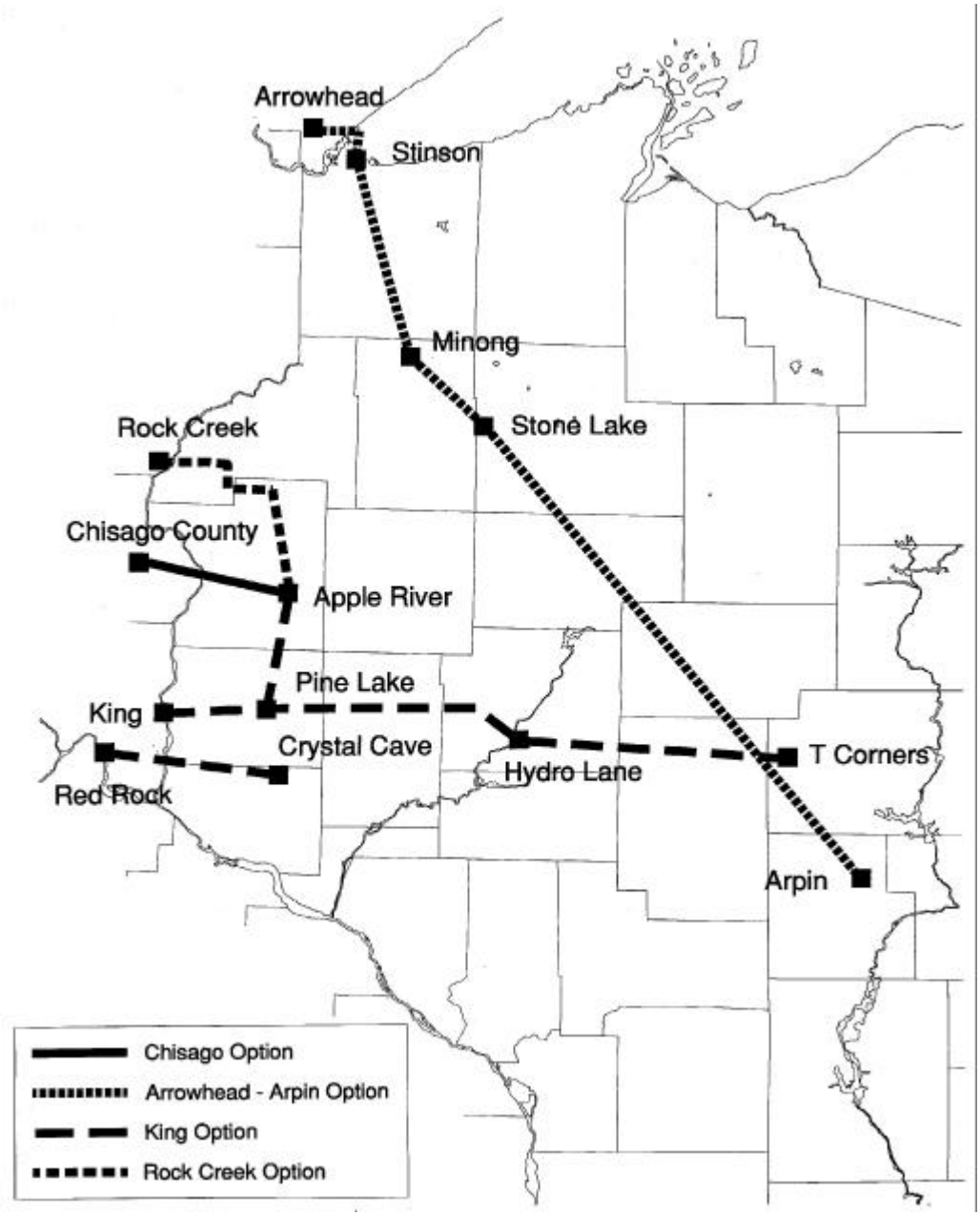


Table 2-8 Economic comparison of system alternatives ($ millions) base transfers, losses at $1.50/watt

System Alternative	Construction Cost	Loss Penalty or (Credit)	Comparative Plan Cost	Cost Difference versus Chisago
Chisago-Apple River 230 kV	$51.6	$0	$51.6	$0
King-Hydro Lane 161 kV	$98.0	$15.0	$113.0	+$61.4
Rock Creek-Apple River 161 kV	$66.8	$19.5	$86.3	+$34.7
Rock Creek-Apple River 230 kV	$79.6	$9.0	$88.6	+$37.0
Rock Creek-Washco 161 kV	$68.0	$19.5	$87.5	+$35.9
Rock Creek-Washco 230 kV	$80.7	$9.0	$89.7	+$38.1
Arrowhead-Arpin 230 kV	$161.6	$0	$161.6	+$110.0

Table 2-9 Economic comparison of system alternatives ($ millions) 1,200 MW transfers, losses at $1.50/watt

System Alternative	Construction Cost	Loss Penalty or (Credit)	Comparative Plan Cost	Cost Difference versus Chisago
Chisago-Apple River 230 kV	$51.6	$0	$51.6	$0
King-Hydro Lane 161 kV	$98.0	$31.5	$129.5	+$77.9
Rock Creek-Apple River 161 kV	$66.8	$25.5	$92.3	+$40.7
Rock Creek-Apple River 230 kV	$79.6	$12.0	$91.6	+$40.0
Rock Creek-Washco 161 kV	$68.0	$25.5	$93.5	+$41.9
Rock Creek-Washco 230 kV	$80.7	$12.0	$92.7	+$41.1
Arrowhead-Arpin 230 kV	$161.6	($27.0)	$134.6	+$83.0

Table 2-10 Economic comparison of system alternatives ($ millions) 1,200 MW transfers, losses at $4.00/watt

System Alternative	Construction Cost	Loss Penalty Or (Credit)	Comparative Plan Cost	Cost Difference versus Chisago
Chisago-Apple River 230 kV	$51.6	$0	$51.6	$0
King-Hydro Lane 161 kV	$98.0	$84.0	$182.0	+$130.4
Rock Creek-Apple River 161 kV	$66.8	$68.0	$134.8	+$83.2
Rock Creek-Apple River 230 kV	$79.6	$32.0	$111.6	+$60.0
Rock Creek-Washco 161 kV	$68.0	$68.0	$136.0	+$84.4
Rock Creek-Washco 230 kV	$80.7	$32.0	$112.7	+$61.1
Arrowhead-Arpin 230 kV	$161.6	($72.0)	$89.6	+$38.0

Environmental conclusions point to Chisago-Apple River line

In addition to the cost and reliability factors, the potential environmental impacts of the system alternatives have also been considered in narrowing the options to move toward a construction application. The environmental pluses and minuses of each

system alternative are highlighted below. A more detailed environmental assessment of each alternative is in Appendix B.

From an overall environmental perspective, a new transmission line from Chisago Substation to the Apple River Substation appears to be a good solution when compared to the other system alternatives. It is the project of shortest length (about 40 miles). Two of the three river crossings proposed use existing utility corridors and nearly all of the proposed routes use either existing transmission line ROWs or well-developed road corridors. Some new ROW would be needed adjacent to the roads and the existing transmission line corridors would need to be expanded. Portions of the project pass through densely populated areas, but design options for reducing the visual impacts of the line(s) could be used.

The Rock Creek to Apple River alternative is longer (about 55 to 60 miles). There are physical and environmental constraints at the St. Croix River crossing location. These include gas and electric transmission lines bored under the river south and north of the STH 70 bridge, two state forests, the Marshland Visitor Center and many river-related recreational facilities (picnicking, boating, canoeing, camping) within sight of the crossing. A new high-voltage line could mostly follow existing distribution and transmission line ROWs, however, these corridors would have to be widened substantially.

The construction for a King to Apple River/Red Rock to Crystal Cave alternative (130 miles) can mostly be done within existing transmission line ROWs. It would require rebuilding two existing crossings of the St. Croix River. About 26 miles of new line would either require a new ROW or expansion of an existing ROW. Because of the presence of the A.S. King power plant located on the western shore of the St. Croix River, adverse aesthetic effects associated with rebuilding the existing A.S. King to North Hudson crossing would be relatively negligible. However, rebuilding the overhead Red Rock to Crystal Cave 115 kV line which is located in a very scenic and sparsely developed setting would maintain an overhead line at this scenic location into the foreseeable future. Because a management goal for the Lower St. Croix Riverway is to reduce structures and uses on the river that detract from the scenic quality of the Riverway, converting this crossing to an underground design should be considered if the line is rebuilt or upgraded.

The Arrowhead to Arpin alternative is five times longer (about 210 miles) than the Chisago to Apple River option and crosses or borders many significant biological resources. Like the Chisago Transmission Project (and the other system alternatives), the Arrowhead to Arpin option has many opportunities for corridor-sharing that could mitigate some of the environmental impacts of constructing and maintaining a new high-voltage line. Over long distances, however, railroads and gas pipelines are not the optimal corridors for ROW sharing due to accessibility concerns and physical features that result in less ability to effectively overlap the ROW (see Appendix B - Arrowhead

to Arpin). This alternative also requires a crossing of the St. Croix National Scenic Riverway as well as several other major waterways.

The effect of the Regional Transmission Study of 1998

In Chapter 1, the genesis and description of the Regional Transmission Study are provided. The purpose was to identify regional transmission constraints and options to relieve those constraints. Twelve options involving new major transmission lines were distilled from numerous possibilities. The Commission issued a report to the Wisconsin Legislature about the analysis and the options on September 1, 1998. The Executive Summary of the report, including a table of the "short list" of 12 options and a map of them, is included as Appendix C.

The development of those plans required that solutions to local area problems be incorporated first so that subsequent problems and options related to regional power transfers would stand out. Any system alternative (Chisago, King, Rock Creek, Arrowhead) could have been assumed for the regional study as the solution to local problems in northwestern Wisconsin. At the time, the Chisago Project was viewed as the most reasonable system alternative, so it was assumed as the solution.

Thus, the Chisago Project was included in 11 of the 12 options as a proxy solution for the "local area" problems in northwestern Wisconsin. A proxy solution was not needed for the remaining option (Option 5a) since that option would connect the Chisago County-Weston 345 kV line to the new Lawrence Creek Substation and the Apple River Substation to solve the "local area" problems. Essentially, a Chisago County-Apple River line was included in all 12 options – in 11 options as a 230 kV line and in one option as a 345 kV line.

Due to its configuration, Option 5a solves local area needs and regional needs. In addition, Option 3j (Arrowhead-Weston 345 kV) could be reconfigured (by adding facilities and connections) in such a way that it would solve local and regional electric problems, much like the Arrowhead-Arpin system alternative is configured. Further analysis is in progress, on the option listed in Table 2-11, to provide information as to which of the options should be built for regional needs, and thereby resolve what impact, if any, construction of such an option would have on the Chisago Project.

Ongoing analysis of the regional transmission options

The utilities, Commission staff and others have already begun to perform detailed analysis of the 12 regional transmission options. Based on a number of factors, 8 of the 12 options have been eliminated, but variations of two options have been added. Table 2-11 lists the six remaining options:

Table 2-11 Regional options being analyzed in detail

Option No.	Option Description
1c	Salem-Fitchburg 345 kV
2e	Prairie Island-La Crosse-Columbia 345 kV
3j	Arrowhead-Weston 345 kV
5a	Chisago-Weston 345 kV
5b (new)	Chisago-Weston 230 kV
9b (new)	Lakefield-Adams-Genoa-Columbia 345 kV

Computer models were used to test how well each option performs electrically with respect to phase angle, voltage, and dynamic stability. In addition, further economic and environmental analysis is being performed. The analysis is expected to be complete by March 31, 1999. Some information about the various options is expected to be available for the Commission's public hearings for the Chisago Project, which will help determine if the regional options would affect the Chisago Project.

Our office contacted Wisconsin Electric Power Company (WEPCO) on your behalf and requested additional

Chapter 3

Chapter 3 - System and Route Alternatives

This chapter briefly describes:

- How the system alternatives were chosen.
- How the utilities select potential power line routes.
- Public input that has occurred so far.
- Route segments that have been dropped or added.

Before the Commission can authorize a utility to construct a utility project, the Commission reviews and analyzes many plans and the effects of these plans on the electrical system. The Commission decision is based on the requirements of two state laws, the Power Plant Siting Act (Wis Stat. § 196.491) and the Wisconsin Environmental Policy Act (Wis. Stat. § 1.11). The Commission has the authority to approve, reject, or modify projects proposed by utilities.

The Commission staff uses the following process when reviewing utility proposals. First, it identifies the "problem" that the utility is trying to solve and possible solutions to the problem. The solutions are called the "system alternatives." Next, staff evaluates the pluses and minuses of each system alternative and determines if the system alternative proposed by the applicant is appropriate. Finally, staff identifies the route options for the proposed system alternative and evaluates them with respect to cost, design, and environmental impacts.

Defining the System Alternatives

Because several of the transmission solutions described in Chapter 2 involve a transmission line that spans the Minnesota/Wisconsin border and would require approval in both states, the Commission and the MEQB agreed to coordinate their review of this project. In June 1997, the MEQB, the Minnesota agency responsible for

choosing routes for a transmission line at the proposed 230 kV voltage, decided which system and route alternatives it would analyze. Although the Wisconsin Commission had decided in Advance Plan 7 that the Chisago Electric Transmission Line Project was the best system alternative, Commission staff re-evaluated the system alternatives and found the Chisago project still the best alternative. A discussion of the cost, engineering, and environmental aspects of the system alternatives is given in **Chapter 2** and **Appendix B**.

How the Utilities Looked for Routes

In early 1996, after receiving planning approval in Advance Plan 7 for the Chisago-Apple River system alternative, the applicants (NSP and DPC) hired several consultants to identify the environmental features and constraints within the project area and to investigate feasible locations and transmission line designs for crossing the St. Croix River. Using this information, the applicants identified many potential routes for the proposed new lines. The applicants presented these potential routes for comments at public meetings in 1996. Several months later, they filed a construction application with the Commission, the MEQB, and the Rural Utilities Service (RUS).

When looking for potential power line routes, the applicants considered several factors:

- Sharing rights-of-way with existing power lines, roads, gas pipelines, and railroads.
- Avoiding or minimizing impacts on significant natural resources, such as the St. Croix National Scenic Riverway, state parks, state forests, or designated State Natural Areas.
- Using land use boundaries, such as section lines or property lines.
- Minimizing overall distance as a means of lowering construction costs and reducing electrical line losses.

The applicants used air photos, land use maps, topographic maps, plat maps, and wetland maps to identify potential routes. The applicants asked for input from many state and federal agencies, municipal government offices, and regional planning commissions. (See section D, "Other Government Agency and Public Participation in this Project.") Public meetings were held in the project area to gain more information about possible routes and substation sites. Field checks (aerial viewing and ground truthing) were made throughout the routing process to identify potential problems and routing opportunities and constraints.

Public Input on Route Selection

The applicants held several public meetings within the project area during May 1996 to inform the public of the project and the potential power line routes. Commission staff attended these meetings. The applicants recorded the public comments and considered them in completing their application for the project.

The RUS also held scoping meetings in the project area in June 1996. Many public comments were filed with the RUS. The RUS prepared the "Summary Report of Public Scoping Meetings and Written Comments" in October 1996.

The regulatory process of the MEQB included the appointment of a Citizen Route Advisory Task Force to review the proposed project and make recommendations regarding routes in Minnesota. This task force met regularly throughout the review process. Commission staff attended several of these meetings.

A citizen-based intervenor group, the Concerned River Valley Citizens, Inc. (CRVC), has offered comments and testimony throughout the review process and will participate in the public hearings in both Minnesota and Wisconsin.

Additional information and comments have been received by Commission staff in the form of letters and phone calls from members of the public.

Other Sources of Information Used to Define Routes

Additional information related to the environmental and engineering aspects of the project became available as the route analysis progressed. Commission staff has also reviewed:

- Comments from the general public, landowners, and organized citizen groups.
- Construction application filed by NSP and DPC in September 1996. These applications contain environmental impact reports and outline the electrical needs for the area.
- Information about the number and proximity of residences and businesses to the proposed power lines.
- Projected electromagnetic fields (EMF) calculations completed by the applicants.
- Locations of threatened and endangered species or communities within the project area. The Wisconsin DNR Bureau of Endangered Resources and the Minnesota DNR Section of Ecological Services made this information available.

- A cultural resources survey conducted by a consultant hired by NSP and DPC.
- Field visits to all proposed routes in Wisconsin and affected substations by Commission staff.

How the Commission Staff Determined Routes for This Project

When defining and selecting power line routes conflicting interests often arise. In selecting possible routes, the applicants considered numerous alternatives. Some of these route alternatives are very close to one another geographically, have very similar impacts, or have "problem areas" which make them less preferable than other routes.

Commission staff reviewed and analyzed all of the applicants 'proposed route alternatives. In an effort to reduce confusion and narrow the focus of the project to options that had a reasonable likelihood to be permitted or approved, Commission staff eliminated segments or routes with serious faults that could be avoided by choosing another route alternative. Commission staff also added several route segments in areas where the routing options appeared to be limited.

Table 3-1 shows segments that were dropped by the Commission staff and why they were dropped. Table 3-2 indicates segments that were added by Commission staff.

Table 3-1 Proposed transmission segments dropped by Commission staff

Location	Segment	Explanation
About 1.5 mile south of Centuria	QQ	This segment runs cross-country between 208th and 150th Street north of Deer Lake. It is not a reasonable alternative when compared with other alternatives that share ROW with a road or another transmission line.
North of Mud Lake	TT	This segment connects QQ to US Highway 8. It is not needed if segment QQ is dropped.

Table 3-2 Proposed transmission segments added by Commission staff

Location	Segment	Explanation
Highway 35 from McKenney Street to Trap Rock Road	JJ_2	Provides an alternative to routing one or more lines through Interstate Park.
East from the hydroelectric dam on Louisiana Street, Blandings Wood Road, East Pine Street, and along an existing 69 kV line to USH 8	101	Provides an alternative route for the 69 kV or 230 kV line through the city of St. Croix Falls. There is not enough clearance to route both lines along this route.
USH 8 from ¼ mile east of Walmart to Segment SS	102	Connecting segment from the 69 kV ROW to Segment SS.
USH 8 from Segment SS (208th Street) to Segment UU (150th Street)	103	Connecting segment linking SS and UU. Provides an alternative to the existing 69 kV line ROW to the south.
STH 46 from USH 8 to segment MM (near Birchwood Lane)	104	Avoids placement of three transmission lines on segment WW.

Numerous route options are under consideration due to the following reasons:

- The need to rebuild the 69 kV line and to construct a new 230 kV line.
- The three possible river crossings.
- The potential for underground and overhead designs through the city of St. Croix Falls.

The project area has been divided into two sectors, the St. Croix Sector and the Apple River Sector. The St. Croix Sector includes the route options between the St. Croix River and Segment SS (near 208th Street). The Apple River Sector includes route options between Segment SS (near 208th St.) and the Apple River Substation. Each route option in the St. Croix Sector begins at one of the three river crossings proposed by the applicants. Any of the route options in the St. Croix Sector can be matched with any of the route options in the Apple River Sector.

St. Croix Sector

The route options of the St. Croix Sector have been named to designate the river crossing used, the path followed by the 230 kV, and the path followed by the 69 kV line.

SC-1. The **Dam-Louisiana-Washington** Route would cross the St. Croix River at the dam, route the 230 kV line underground on Louisiana Street and rebuild the 69 kV line overhead along Washington Street and the existing ROW.

SC-2. The **Dam-Washington-Louisiana** Route would be the same as above except that the 230 kV would be overhead along the Washington Street existing ROW while the 69 kV line would be underground on Louisiana Street.

SC-3. The **Dam-Double Washington** Route would cross the river at the dam and route both lines south on Washington Street in the existing 69 kV line ROW. One of the lines would likely be underground and the other overhead in the city of St. Croix Falls.

SC-4. The **North-Washington** Route would use the north crossing and Segments PP and SS for the 230 kV line, while the 69 kV line would be rebuilt along its existing ROW.

SC-5. The **South-Washington** Route would use the southern crossing for the 230 kV line and rebuild the 69 kV line along the existing ROW. (Segment KK would be a double-circuit 230/69 kV line.)

The Apple River Sector (Segment SS to the Apple River Substation)

The route options in the Apple River Sector are named to designate the paths followed by the 230 kV and the 69 kV transmission lines.

AR-1. The **Double South** Route would be a double-circuit 69/230 kV line along the existing 69 kV line ROW.

AR-2. The **Double South - USH 8** Route would begin as a double-circuit 69/230 kV line along the existing 69 kV line ROW. The double-circuit line would turn north off of Kennedy Mill Avenue and follow 150th Street to USH 8. The double-circuit line would proceed east along USH 8 toward the Apple River Substation. At STH 46, the 69 kV line would go south to Segment MM. The 230 kV line would be double-circuited with another DPC 69 kV line (coming from the north) along segment WW and be built as a single-circuit line on segment XX.

AR-3. The **Split** Route would use two separate corridors for the 230 kV and 69 kV lines. The 230 kV line would follow USH 8 east from Segment SS for about 11 miles before turning south to the Apple River Substation along segment WW. The 69 kV line would be rebuilt on its existing ROW. This route may be modified at the Apple River Flowage crossing.

Chapter 4

Chapter 4 - Major Environmental Considerations of Sectors and Routes

This chapter provides a general comparison of the routing considerations in each sector and the major impacts of the route alternatives.

This chapter includes:

- A brief characterization of the important features and design considerations in each sector.
- A comparison of the overall acreage and land uses affected by the proposed project for each route.
- A description of the estimated electromagnetic fields for the proposed line designs.
- A general discussion of the ROW requirements and corridor-sharing opportunities along the proposed routes.
- A short overview of power line effects on property values.

Differences Between the Sectors

Distinct differences exist in the types of resources and design considerations that are important in the Apple River Sector and the St. Croix Sector. The presence of the St. Croix River, a federally-designated scenic waterway, and the city of St. Croix Falls are the primary routing considerations in the St. Croix sector while more typical landscape and land-use issues define the routing considerations in the Apple River sector.

The agencies that protect and manage the St. Croix National Scenic Riverway participated in discussions about the options for placing a transmission line across the river during the planning phase for this project and during its review. Assessing the

potential impacts on the inherent aesthetic and recreational qualities of the river and the biological resources present in and near the river corridor is one of the primary goals of this EIS. Evaluating these impacts will help determine if and where the 230 kV line proposed by NSP and DPC should cross the St. Croix River.

In addition, the cities of St. Croix Falls and Taylors Falls require special consideration in the siting process. Concerns about the number of homes in close proximity to the line, effects on commercial and retail businesses and other community issues must also be weighed when choosing a route in this sector.

In contrast, routing considerations in the Apple River Sector focus on more typical power line siting issues, such as ROW clearing through woodlands, impacts on wetlands and agricultural land use concerns. Aesthetics is also an important consideration in the rural environment in settings where few large man-made structures exist.

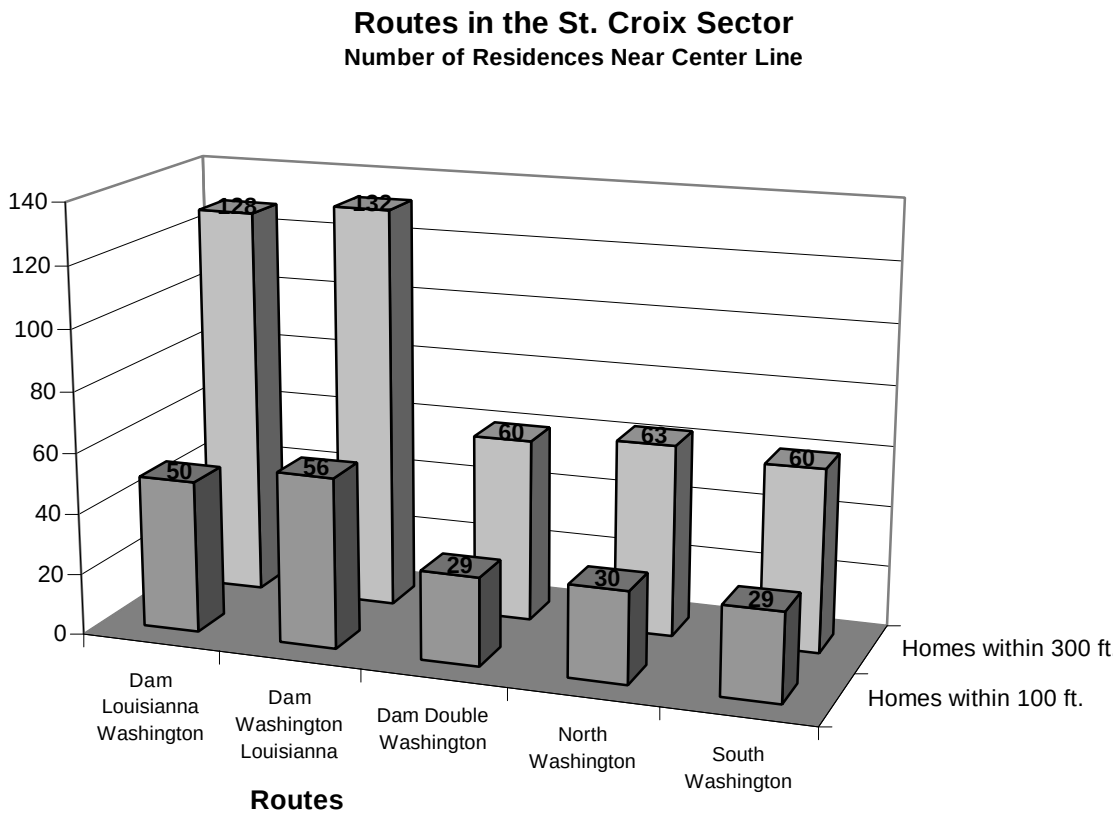
Comparison of Acreage and Land Use Impacts

St. Croix Sector

This sector contains the three proposals for a river crossing and the five route options leading to the intersection of Segment SS (near 208th) and USH 8. The three river crossing locations vary substantially in character, visitor use, and types of resources affected (see Chapter 5). The North crossing is the only option that would not share corridors with another existing utility facility. Use of the proposed Dam crossing could consolidate or eliminate some of the existing electric transmission and distribution structures and wires that presently cross the river at the dam. Numerous mussel species that are listed by the state or federal government as threatened, endangered, or of special concern are present in the river near the dam and the proposed south crossing. However, no known occurrences of state or federally listed mussel species have been observed at the north crossing.

When comparing the types of land use affected by the remainder of the routes east of the river, the North-Washington Route is the only route option that would have a significant effect on agricultural lands. The other alternatives in this sector pass through mostly urban and residential areas located along existing power line or road corridors. An estimate of the number of homes within 100 feet of the proposed centerlines for these route alternatives is included in Figure 4-1. The routes with the most residences within 100 feet of a proposed centerline are those that use the Dam crossing and are routes along Louisiana Street.

Figure 4-1 Number of residences near the proposed centerline in the St. Croix Sector



Apple River Sector

In the Apple River sector, the Split Route is the longest proposed route option. However, length, by itself, doesn t always provide a clear indication of the amount or type of resources affected. For example, although the Split Route is the longest route option, it would affect the least amount of agricultural land when compared with the other two options. All three routes are quite similar in the amount of wetlands and forests affected.

Figure 4-2 Comparison of new land use impacts in the Apple River Sector

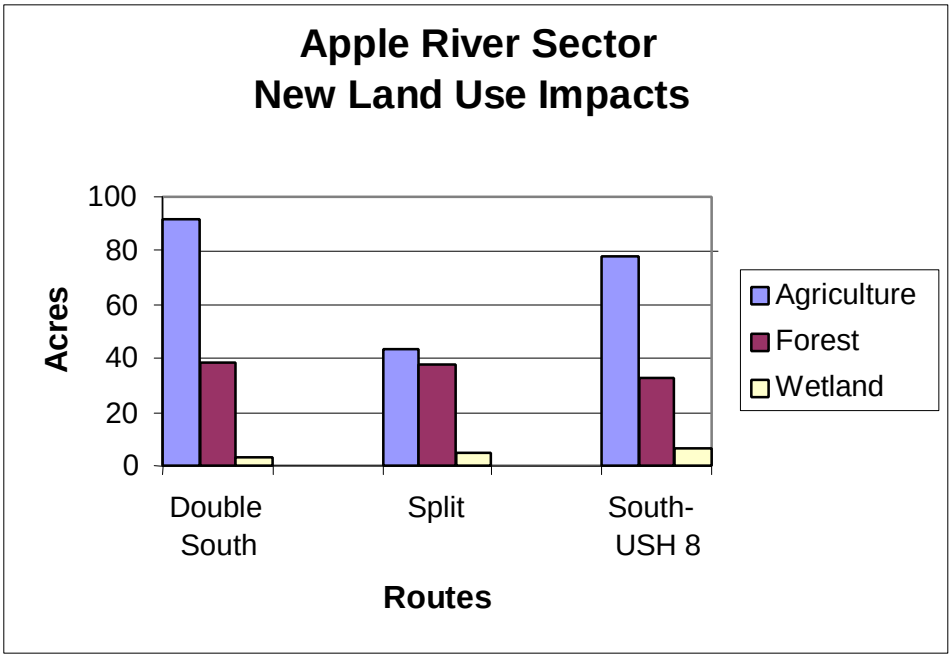
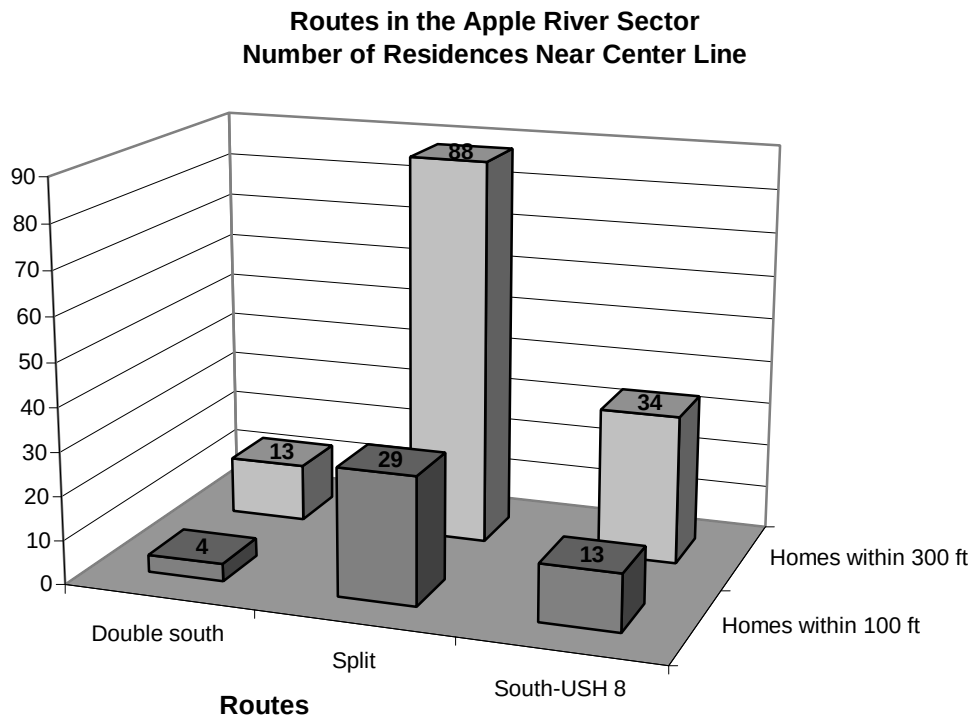


Figure 4-3 Number of residences near the proposed centerline in the Apple River Sector



Magnetic Fields

The subject of magnetic fields and human health is very complex. To date, there has been no strong or convincing proof that exposure to EMF constitutes a serious health hazard to humans. Several epidemiological studies have shown an association between the risk of childhood leukemia and the kind of electrical wires outside the home. However, other epidemiological studies have found no link to leukemia. For example, a study published in The New England Journal of Medicine in July 1997 found little evidence that exposure to magnetic fields in a residential setting increases the risk of acute lymphoblastic leukemia in children. Taken as a whole, the studies conducted to date have not been able to establish a cause-and-effect relationship between actual magnetic field exposure and human disease.

In 1991 the U.S. Congress requested the National Academy of Sciences to review the literature on the health effects from exposure to EMF. The National Research Council was given the task of conducting the review. A 16-member committee composed of scientists and other experts reviewed more than 500 studies spanning 17 years of research. The studies reviewed covered a wide range of subject areas including cellular

and molecular effects, epidemiology, and animal and tissue effects. Based on this comprehensive evaluation, the committee issued a 300-page report in October of 1996. This report concluded that the current body of scientific evidence does not show that exposure to EMF presents a health hazard to humans. The report further states that no conclusive or consistent evidence to date has shown that exposure to residential EMF produces cancer, neurobehavioral problems, or reproductive and developmental effects.

In 1992 the National Energy Policy Act established a federal scientific and engineering research program to study EMF. This program is called the EMF Research and Public Information Dissemination (RAPID) Program. The National Institute of Environmental Health Sciences (NIEHS) is charged with evaluating the human health effects of exposure to EMF. In the spring of 1998, a scientific working group established to advise the NIEHS voted to list EMF as a Class 2B possible carcinogen using a classification system developed by the International Agency for Research on Cancer (IARC). This is not a determination of carcinogenicity. In the IARC classification system a substance must be placed in Class 2B if there is inadequate epidemiological evidence and insufficient animal data supporting carcinogenicity. In the case of EMF, the scientific support for a serious health risk is very small, even after over 15 years of research. The NIEHS continues to study and evaluate EMF. While a scientific consensus has yet to be reached on this issue, evidence is growing that any health concern is likely to be small.

There is still some concern, however, in the scientific community. This concern arises from the persistence of findings from a number of studies that show an association between residential power line configurations and childhood leukemia. At this time, it is unknown what may be the cause of such an association. The National Research Council's EMF committee recommended continued research focusing on the specific causes of this link to childhood leukemia. The committee also identified the need for more research into the relationship between high exposures to EMF and breast cancer in animals already exposed to other carcinogens.

This issue is further complicated by the lack of a plausible biological mechanism that explains how exposure to magnetic fields might cause human disease. In addition, sources of magnetic fields are not limited to electric power lines. Sources of magnetic fields include appliances such as vacuum cleaners, microwaves, computers, electric blankets, fluorescent lights, electric baseboard heat, and even the electrical wiring in the home. We are exposed to magnetic fields at home, in the work place, and in school. Since magnetic fields are created whenever we use electricity, utilities and the Commission have limited control over magnetic field exposure.

In an effort to address concerns about EMF exposure from power lines, the Commission, in May 1992, issued an order specifically about EMF (Docket 05-EP-6). This decision was based on the record of testimony given during 5 days of scientific and 4 days of public hearings on the subject of EMF. The decision establishes specific

actions that the Commission found are a reasonable response to concerns about EMF, given the scientific knowledge available at the time. In December 1994, the Commission reviewed research findings published since its 1992 EMF order and again heard expert witnesses on the topic of EMF and human health effects (Docket 05-EP-7). In December of 1995, the Commission reaffirmed its 1992 EMF order. In August 1998 the Commission once again reviewed its policy on EMF and heard expert witnesses on this topic (Docket 05-EP-8).

As a result of the evidence developed during these EMF proceedings, the Commission continues to monitor EMF research and regulatory developments in the United States and abroad. The Commission has also ordered utilities to consider EMF when proposing to construct transmission lines by providing information on anticipated magnetic field levels resulting from any proposed high-voltage transmission line. In addition, the Commission requires utilities to provide information to the public about EMF, to perform EMF measurements in customer's homes upon request, and to contribute to scientific and engineering research on EMF.

Some transmission line structure designs have lower magnetic field characteristics than others. Because magnetic fields decrease with distance from the source, the difference in EMF levels produced by different structure designs will diminish with distance as well. The benefits of using low-EMF structures therefore decrease with distance from the line. Usually, the differences in EMF profiles between various structure designs are relatively small. When building double-circuit transmission lines, EMF levels can be reduced by arranging the circuit phase wires to maximize EMF reduction. This should be a standard course of action for any double-circuit line.

For this case, the applicants supplied Commission staff with estimates of the EMF for all of the proposed structure designs.

These calculations are based on the voltage, design, and projected load (current flow) of the new line. Different line designs have been proposed for different locations along the proposed routes. Estimated magnetic fields are shown for the following designs: a low profile single-circuit 230 kV line (with and without an underground 69 kV line in the same ROW), underground 69 and 230 kV lines, single-circuit long-span (900 foot) 230 kV line and a long-span (650 foot) double-circuit 230/69 kV line. The locations (segments), where these designs will be used, are given in the route description tables of Chapter 6.

Table 4-1 Calculated magnetic fields (mG) for OVERHEAD transmission line designs

	Distance to Proposed Centerline								
	300	200 '	100 '	50 '	0	50 '	100 '	200 '	300 '
Single circuit 230 kV I-string long-span	1.7	3.8	13.4	38.5	108.1	45.3	14.9	4.0	1.78
Single circuit 230 kV Braced I-string long-span	1.54	3.4	12.0	34.4	100.1	40.6	13.4	3.6	1.60
Single circuit 230 kV Low profile/braced post	1.2	2.8	10.6	36.0	170	38.2	11.2	2.9	1.3
Double circuit 230/69 kV I-string long-span	1.1	2.6	10.8	34.7	74.3	14.9	4.0	1.3	0.7
Double circuit 230/69 kV Braced I-string long-span	1.0	2.4	9.8	30.8	65.1	13.8	4.6	1.5	0.7

Table 4-2 Calculated magnetic fields (mG) for UNDERGROUND transmission line designs

	Distance to Proposed Centerline								
	300 '	200 '	100 '	50 '	0 '	50 '	100 '	200 '	300 '
69 kV 1 cable per phase SCFF or XLPE			0.5	2.0	107	2.0	0.5		
230 kV 2 cables per phase SCFF or XLPE			1.0	3.9	186	3.9	1.0		
230 kV 3 cables per phase SCFF or XLPE			1.0	4.0	153	4.0	1.0		
230 kV 2 cables per phase HPFF with 2 pipes				0.1	5.2	0.1			

Table 4-3 Calculated magnetic fields for MIXED (underground/overhead) transmission line designs

	Distance to Proposed Centerline								
	300 '	200 '	100 '	50 '	0 '	50 '	100 '	200 '	300 '
230 kV overhead 69 kV underground Low profile/braced post	1.3	2.9	12.1	46.8	118	29.8	9.3	2.6	1.2
69 kV overhead 230 kV underground 2 cables per phase SCFF or XLPE		0.8	3.0	8.4	191	7.3	3.1	0.9	

Calculations of magnetic field levels were based on normal load current projected for the year 2010. The Commission defines normal load current as 80 percent of the peak current.

These tables show estimated EMF levels for distances on both sides of the centerline because the configuration of wires on most transmission structures is asymmetrical (two conductors on one side and one on the other). Field levels are shown for distances out to 300 feet unless they decreased below typical background levels found in homes (1-3 mG).

In the Apple River sector, the greatest number of homes within 100 feet of a proposed centerline is on the Split Route. Relocating the existing crossing at the Apple River flowage would reduce the number of homes next to the line in this area.

Right-of-way Requirements

In addition to the size of the area affected, other factors considered in siting new transmission lines are:

- Quality of the existing environment,
- Degree of impact, and
- Opportunity to mitigate potential impacts.

In general, corridor-sharing provides an opportunity to reduce potential impacts of a project. However, the benefits of corridor-sharing vary depending on the type of corridor used and the land use in the corridor. For example, sharing a ROW with another transmission line that is similarly sized may result in no new ROW being needed. Routing a power line next to a gas pipeline that runs diagonally across an agricultural field provides few environmental benefits because the gasline has no post-construction impact on agricultural operations if properly installed.

The Dam Double Washington Route (St. Croix sector) and the Double South Route (Apple River sector) use the existing 69 kV line corridor extensively. The addition of the 230 kV line would require 20 to 50 feet of new ROW over most of the total distance of the route. On the other hand, if the new 230 kV line were built adjacent to USH 8 and the 69 kV line were rebuilt in its existing corridor, the width of the 69 kV line ROW would remain unchanged.

Few of the proposed segments would require cutting new corridors through the middle of forest or wetlands or placing new ROW across agricultural fields (segments M, II, OO, PP and SS are the exceptions). In general, creating a new corridor through these types of areas causes greater impact than placing a line along the edge of a field, woodland, or wetland. Siting new corridors fragments the interior habitat and causes major changes in the surrounding woodlands or wetlands due to increased light and wind penetration.

Routing the new 230 kV line along USH 8, Highway 35, or in the existing 69 kV line ROW would mostly affect edges of woodlands, wetlands, and fields. Repeated "chipping away" at the edge of forest, wetland, and meadow habitat can have long-lasting effects on the quality of these resources by allowing the establishment or encroachment of weedy species and contributing to habitat fragmentation and isolation.

Effects on Property Values

A common concern of landowners along proposed transmission line routes is the potential adverse effect on property values. Many studies have been conducted in an attempt to determine if the effect is real, the magnitude of the effect, and how other property characteristics relate to the potential effect of a power line sited across or near private property (see the overview on "Environmental Impacts of Electric Transmission Lines").

Although the results of these studies are not conclusive, several general points of agreement have been reached:

- Power lines have the potential to reduce the sale price of residential and agricultural property. Agricultural values are likely to decrease if the location of power line poles affect farm operations.

- Effects on the sale price of smaller properties tend to be greater than the effects on sale price of larger properties.

- Other factors, such as lot size, square footage of a house, and neighborhood characteristics, have a much greater effect on sale price than the presence of a power line.

- Effects on price and value appear to be the greatest immediately after a new power line is built or an existing ROW is increased in size. These effects appear to diminish over time.

Individual perceptions play an important role in determining the relative importance of a power line on landowners 'use and enjoyment of their property. While aesthetic issues or EMF concerns may diminish the perceived value of property located along a power line for some individuals, others may find the line to be a very minimal intrusion.

Personal concerns about property values are a factor in utility negotiations with landowners for easement payments. The Agricultural Impact Statement (AIS) which is being prepared for this project by DATCP, would assist farm owners in their easement negotiations if the project is approved. Copies of the AIS will be available at the public hearing.

Chapter 5

Chapter 5 - Proposed River Crossings – Locations and Designs

This chapter describes:

- The proposed river crossing locations.
- The proposed line designs at each location.
- Cost comparisons for each location and design.
- Environmental considerations for each location and design.

The applicants, NSP & DPC, have proposed three river crossing locations for a 230 kV transmission line between the Chisago Substation and the Apple River Substation. These locations were selected after an initial study by the utilities and their consultants, Greystone Environmental Planners, Scientists and Engineers, and Black and Veatch. The three proposed locations are:

1. **The North Crossing** - This is a 300-foot-wide corridor about 4.5 miles north of USH 8. This easement was retained by NSP when it sold property north of the St. Croix Falls hydroelectric plant to the National Park Service in the late 1980s.

2. **The Dam Crossing** - This is an existing crossing for distribution and transmission lines at the dam and hydroelectric facility in St. Croix Falls, Wisconsin. Taylors Falls, Minnesota, is directly opposite St. Croix Falls on the west side of the river.

3. **The South Crossing** - This is an existing Viking gas pipeline crossing about two miles south of USH 8.

Proposed River Crossing Line Designs

To minimize the potential aesthetic impacts at each of the proposed crossings, several power line designs for crossing the Riverway were investigated for this project. Black and Veatch, a consultant hired by the applicants, summarized available technologies and their suitability at each of the three proposed river crossing locations.

Black and Veatch evaluated the following power line designs for the river crossing:

- Overhead
- Horizontal Directional Drill (HDD)
- Direct Lay Trench
- Tunnel
- Submarine Cable
- Bridge Construction

Engineering, cost, or aesthetic considerations ruled out submarine cable, tunnel, and bridge as infeasible design options. Submarine cable construction would consist of a large conduit containing the conductors. Weights will hold the cable down to the riverbed. Submarine cables are generally successful when used to cross lakes or other water bodies without strong currents. Laying a cable on the riverbed would cause erosion and change the sedimentation pattern. Underwater tunnel construction was deemed not feasible due to the extremely hard bedrock in this portion of the river valley. Mounting the 230 kV conductors on the sidewalls or underdeck of the USH 8 bridge is not possible because the bridge could not support the additional weight of the conductors without compromising the safety of the bridge. Construction of a separate pedestrian walkway to accommodate the cables was also considered, but was ruled out due to adverse aesthetic impacts on the scenic riverway.

The line designs carried forward in the application include typical overhead construction with special ROW considerations to minimize views of the line and two types of underground crossings--trench installation, and horizontal directional drilling.

Overhead

Applicants may use low-profile tubular steel poles for an overhead crossing to reduce visual impacts and provide adequate strength. They have stated that the conductors would be "double bundled" (two closely spaced wires per phase) to provide the required capacity of the line. They also plan to arrange the three-phase conductors in a flat configuration to further reduce the visual impact of the crossing.

The primary environmental effects associated with construction and maintenance of an overhead line across the St. Croix River include aesthetic considerations, erosion during construction, and the potential for bird-wire collisions

Horizontal Directional Drilling (HDD)

This technology is derived from the oil industry. It involves drilling a 3-inch diameter horizontal pilot hole through the bedrock beneath the riverbed. The pilot hole is drilled with a magnetic steering tool, which controls both horizontal and vertical position. The pilot hole is progressively enlarged until an adequate diameter is achieved. Casing and cable are then pulled through the bore-hole and connected to the underground land-based portions of the line. Entry and exit locations are then backfilled and restored.

HDD technology does involve some environmental risks. During construction, a bentonite (an inert clay material) slurry is continuously forced through the bore-hole to lubricate the rotating drill head. If a fissure in the bedrock is encountered or caused by drilling, the bentonite slurry could leak into the river. If the leak is large or the river current does not rapidly disperse the bentonite, the sediment could adversely affect water quality and any aquatic organisms, such as mussels, that are present near the fissure. In cases where the bedrock is extremely hard, drill bits can break or become lodged in the bore-hole, requiring the drilling of another hole. Finally, the entry and exit sites for the drilling operation can be heavily disturbed during the drilling process. It is, therefore, important that reclamation of these sites should be included in the construction contract.

Direct Lay Trench

This method is similar to land-based trenching with the complication of working underwater and in a riverbed. The St. Croix River crossings would require 650 to 850 feet of underwater trench. It would also require diverting the main flow of the river while trenching, assembling casing on floating platforms, attaching weights to the casing, lowering of the casing into the open trench, anchoring, and finally covering the trench with clean backfill and protective sand-cement bags.

The technical difficulty and potential for adverse environmental effects associated with trenching would be substantial in a river as wide and fast-flowing as the St. Croix River. Potential problems would include destruction of bottom-dwelling organisms due to massive disturbance of the river bottom, erosion and sedimentation from the spoil pile during construction, and permanent changes in the flow and sedimentation patterns. A failure in one or more cables that are trenched in could require more disturbance when locating and repairing the fault.

Common Design Characteristics of Underground Technologies

The applicants have stated that all underground technologies would require installation of two or three circuits. Installation of multiple circuits is necessary because underground cables have less current-carrying capacity. Two underground circuits are required to give a current carrying capacity equal to one double-bundled overhead circuit. The third circuit is required to ensure service continuity in case of failure of one circuit. The need to install three circuits increases the ROW requirements in areas where the line is placed underground.

A transition station would be required at each end of the underground section of line. This station would consist of one or more structures that support the conductors as they change from underground to overhead operation. Usually the conductors are attached to the surface of the pole, but they may be housed within the pole if tubular steel structures are used. For a high-voltage line, it is likely that a three-pole transition station would be used. See Figure 5-1.

Figure 5-1 230 kV Transition Station

Underground Cable Technologies

Three types of underground cable technology are being considered: high-pressure fluid filled (HPFF), self-contained fluid-filled (SCFF), and cross-linked extruded dielectric (XLPE). Any of these can be used for HDD or trenched construction

HPFF (sometimes referred to as high-pressure liquid filled, HPLF) has been the standard underground cable in the U.S. since the 1930s. Today 80 percent of the 4,000+ miles of underground transmission cable installed in the United States (U.S.) is HPFF. If HPFF were used for this project, the 230 kV cables would require an 8 5/8-inch cable pipe.

The advantages of HPFF construction are (1) Very high reliability in the U.S. since 1930s. (2) Generally fewer joints than SCFF or XLPE cables allowing longer cable pulls.

The disadvantages are: (1) Requires cathodic protection system (2) Requires large quantity of dielectric fluid (3) Requires auxiliary power supply for fluid pressurization (4) Requires relatively long repair times.

SCFF cables operate under ionization-free conditions, and, therefore, maintain greater than one atmospheric pressure. SCFF cable has been used extensively outside the US since the 1920s with high reliability.

This technology has the following advantages: (1) Can be installed in a duct system or direct buried. (2) Much simpler than high-pressure fluid filled (HPFF) pipe system.

The disadvantages are: (1) Limited experience in the U.S. (2) Risk of undesirable grounding of cable sheath (3) Susceptible to fluid leaks (4) Efficacy affected by elevation changes along the route (5) Long repair times.

XLPE (sometimes referred to as HVED) cables consist of central copper or aluminum conductors surrounded by an extruded insulation and shielding and an outer jacket. There are numerous manufacturers throughout the world; at end of 1993 there were 170 circuit miles of 220-275 kV XLPE cables in service

These cables have the following advantages: (1) No fluid that can leak or burn (2) Minimal operation and maintenance requirements (3) More suitable on slopes (4) Shorter repair times.

The disadvantages include: (1) Limited U.S. experience with 230 kV installations (2) No U.S. manufacturing facilities for voltages above 69 kV (3) Risk of undesirable grounding of cable sheath.

Cost Comparisons

A cost comparison of an overhead line design versus the three proposed underground designs is shown below for the three river crossing options.

Table 5-1 Cost comparison of overhead versus underground design at the three proposed river crossing locations

Location	North Route		Taylors Falls St. Croix Falls		South Route*	
Overhead	$385,000		$165,000		$385,000	
	HDD	Direct Lay	HDD	Direct Lay	HDD	Direct Lay
HPFF	$4,388,000	$3,680,000	$3,615,000	$3,049,000	$4,388,000	$3,680,000
SCFF	$4,109,000	$3,511,000	$3,415,000	$2,912,000	$4,109,000	$3,511,000
HVED	$4,333,000	$3,734,000	$3,463,000	$2,959,000	$4,333,000	$3,734,000

* At the south crossing the 230 kV line could also be placed underground from bluff to bluff. The total cost of this option is estimated to be approximately $6,662,000.

General Environmental Characteristics of the St. Croix River Valley in the Proposed Project Area

The portion of the St. Croix River Valley that includes the three proposed crossing locations varies considerably in topography, geology, and character. Between Nevers Dam Road, about eight miles north of St. Croix Falls/Taylors Falls, and the southern boundary of Interstate Park in Wisconsin, the river flows through a series of landscapes. North of St. Croix Falls, the river is broad and gently curving, its banks covered by floodplain forests or low wet meadows. Approaching the cities of St. Croix Falls/Taylors Falls, the river valley narrows. The river current increases, cutting a deep gorge through the exposed basalt bedrock. South of the Dalles of the St. Croix River, a designated State Natural Area within Interstate Park, the current slows again as the river moves through a mixture of floodplain forest interspersed with sandstone rock outcrops supporting upland woods.

Due to the outstanding scenic beauty, a high concentration of recreational opportunities and amenities, and the proximity of the river valley to the Twin Cities Metropolitan Area, visitor use in this portion of the St. Croix River Valley is very high. Many trails, campgrounds, and boat landings are located along the riverway and within Interstate Park, which borders the east and west shore of the river in Minnesota and Wisconsin. There is also an abundance of businesses offering recreational services, such as boat tours, canoe rentals and bicycle rentals. About 337,000 people visited Interstate Park in 1997; an additional 14,230 registered at the St. Croix Falls Visitor

Center, operated by the National Park Service. These numbers may not include visitors that take private boat tours, or many who fish and canoe on the river or hike and bike on nearby trails.

The primary activities pursued by visitors include camping, canoeing, hiking, fishing, climbing, and cross-country skiing. In addition to the trails within Interstate Park for hiking and skiing, portions of the Polk County Ice Age Trail, which is part of the Ice Age National Scenic Trail, are located adjacent to the St. Croix Riverway. The Gandy Dancer Trail, an abandoned rail corridor converted to trail, also passes through the city of St. Croix Falls and is a popular bike route in the summer and snowmobile trail in winter months. River use is very high during the summer months. The Minnesota Department of Natural Resources conducted a creel survey of persons fishing and boating on the St. Croix River during the summer of 1997.

With the exception of a relatively small number of homes along the east shore of the river in the city of St. Croix Falls, there are few private residences directly adjacent to the river in this portion of the Riverway. The vegetation and animal life present are characteristic of northwestern Wisconsin and west central Minnesota. Wildlife common along the river throughout this area include white-tail deer, fox, raccoon, muskrats, skunk, mink, black bear, coyote, rabbit, squirrel, and woodchuck.

The St. Croix River Valley also has special significance as nesting habitat and as a migration corridor for many species of birds. In particular, bald eagles (*Haliaeetus leucocephalus*), wood ducks (*Aix sponsa*), and several other duck species nest throughout the river corridor. Many species of hawks, warblers and water birds migrate through the river valley. Observations of trumpeter swans (*Cygnus buccinator*), a state-listed endangered species, have been made by persons living near the river. High concentrations of American woodcocks (*philohela minor)* have also been noted in the St. Croix River Valley during migration peaks.

A detailed description of the land cover and land use at each crossing location is described below. The concerns and issues of the National Park Service, the Wisconsin and Minnesota Departments of Natural Resources, and other state and federal agencies that manage or coordinate the management of the St. Croix National Scenic Riverway and adjacent lands are also included. Input from numerous state and federal agencies was solicited and received throughout the planning and review of this project.

The North Crossing – Specific Environmental Characteristics

This proposed crossing, about 4.5 miles north of USH 8, is located in an area that is relatively undisturbed on both sides of the river. At this location, the St. Croix River is about 800 feet wide, flat, and slow moving. A new ROW 100 to 120 feet in width would be required for overhead long-span steel single-circuit structures or an underground cable design. The proposed ROW would pass through forested areas

approximately ½ to ¼ mile in width on both sides of the river. In Minnesota, the proposed ROW would cross the St. Croix Riverway about 1/8 mile south of the mouth of Dry Creek. The proposed transmission line would drop down a wooded slope, cross State Highway 16 (STH 16), and proceed toward the west bank of the St. Croix River. A high quality northern sedge meadow, about ¼ mile wide, is located between STH 16 and the river. In Wisconsin, a strip of bottomland forest grading into northern mesic forest borders the east river bank. River Road, a narrow gravel road that provides access for canoeists and fishermen parallels the river about 1/8 mile east of the shoreline. Because of the slope and the dense trees, the road is not visible from the river. East of River Road, the proposed power line would traverse up a steep wooded bank rising 50 to 60 feet above the river.

The National Park Service owns and manages a strip of land approximately 400 feet in width along both sides of the St. Croix River in this area. Several canoe/boat landings are found along River Road north of St. Croix Falls. NSP maintained rights to a 300-foot-wide easement for an overhead or underground transmission line within a three-mile section of the river that includes the proposed north crossing. Assuming that all necessary permits and approvals for this route could be obtained, NSP would not need to negotiate or purchase a ROW easement from the National Park Service.

This section of the St. Croix River valley is characterized primarily by sandy, loamy glacial till overlaying sedimentary bedrock of the Paleozoic era. The soils immediately adjacent to the river consist of loams, silt loams, and sandy loams that are poorly drained; prone to flooding, and best suited to woodlands. Soils on the steep slopes adjacent to the river are prone to erosion and droughtiness.

An overhead crossing would most likely be built using tubular steel H-frame structures that would allow a horizontal configuration of the conductors to minimize visual impact. The estimated cost of this alternative is $385,000. Two methods for placing the line underground below the riverbed are technically feasible at this site. HDD would travel 23 feet below the river for approximately 850 feet and continue underground on both sides of the river to a transition station. This option is estimated to cost $4,109,000 with a fluid-filled (SCFF) cable and $4,333,000 with a solid dielectric (XLPE) cable. The line could also be trenched 3 feet deep into the riverbed using the method called direct lay conduit construction. In this case, the cost estimate would be $3,511,000 for SCFF cable and $3,734,000 for XPLE cable. (See Table 5-1.)

If an underground design were used, the location of the transition structures would depend on the length of the underground section of line. From crest to crest the river valley is about ½ to ¾ mile wide at this location. Placing the line underground across the entire river valley and placing transition structures beyond the valley crests would add significantly to the costs, especially if HDD were used for the entire distance. Underground costs could be minimized by trenching in the portions of the line extending upslope from the river even if HDD were used to install the section under the river. However, trenching would likely result in greater environmental impact.

Little or no vegetation clearing would be needed above the line where it is bored underground. Because the line is closer to the surface when it is trenched in, the ROW must be kept clear of all woody vegetation, resulting in a high potential for adverse aesthetic effects and damage to wetlands and forest habitat.

Aesthetics

No roads, bridges, or existing gas or electric lines cross the river at this location. This lack of man-made features, the quiet waters, and diverse vegetative cover provide river users with an opportunity for a rare recreational experience. Construction of a transmission line at this location using either overhead or underground technology would result in the potential for significant adverse visual and aesthetic impacts to this section of the St. Croix National Scenic Riverway. An overhead line would be very visible from the river, looking west across the sedge meadow or east up the wooded stream bank. On the Wisconsin side, a new ROW, 100 to 120 feet wide, would have to be cleared through the forest bordering the shoreline and upslope toward 180th Avenue.

An underground crossing would require a transition area (where the line switches from overhead to underground construction) on both sides of the river. The transition structures that would be used are quite large and bulky and, depending on their location, could have a significant aesthetic impact (see Figure 5-1). Locating the structures further away from the river increases the cost of the underground portion of line.

Archaeological Resources

Thomas Pleger of the Mississippi Valley Archaeology Center completed an initial literature review of archeological and cultural resources at the University of Wisconsin-La Crosse. The report indicates that there is a moderate to high potential for archaeological sites adjacent to the St. Croix River at this location. The State Historical Society of Wisconsin has determined that a Phase I survey would be needed prior to beginning construction regardless of the corridor approved. Depending on the findings of this survey, a more detailed investigation could be needed.

Threatened and Endangered Species

Two species of threatened fish, the river redhorse *(Moxostoma carinatum*) and the greater redhorse *(Moxostoma valenciennesi*) are present in the river at this location. It is unlikely that construction of a transmission line, either overhead or bored under the riverbed, would disturb these fish species. No rare mussels have been identified in the St. Croix River at this location.

Trumpeter swans, an endangered species in Wisconsin, have been observed migrating through this section of the river in spring and fall and some accounts have noted that the swans may rest and/or reside in this area for longer periods. Overhead lines could pose a hazard for these birds because of their flight habits during migration and their space requirements needed when taking off from the water surface.

Red-shouldered hawks (*Buteo lineatus*), a special concern species in Wisconsin and Minnesota, have been observed in this area. Bald eagles and timber wolves (*Canis lupis*), two federally listed species, also occur in the area. If this location for crossing the river were approved, a mussel survey and a more detailed assessment of bald eagle and timber wolf use in the area would likely be recommended.

Wetlands

Several different types of wetlands are present adjacent to the St. Croix River at this location. The dominant species in the northern sedge meadow on the west side of the river is tussock sedge (*Carex stricta*). Few exotic or non-native species are present in this wetland. Driving construction equipment through this wetland, placing one or more structures in this area, or trenching through the sedge meadow to lay an underground line could cause significant damage to this community. These impacts would include disturbance to existing vegetation, compaction of wetland soils, resulting in disruption of water movement, and an increased potential for introduction and establishment of weedy, non-native species such as reed canary grass *(Phalaris arundinacea*) or purple loosestrife *(Lythrum salicaria*). In addition to a high potential for soil erosion, clearing a ROW and construction of an overhead or underground line through the wooded wetland on the east side of the river could result in similar impacts.

Forests

Clearing a new 100 to 110 foot-wide ROW through the lowland forest on the Wisconsin side of the river would likely result in a permanent opening free of woody vegetation. Extreme water fluctuations often contribute to the inability of tree seedlings to reestablish in flood-prone areas. Removal of trees in the forested areas adjacent to River Road and west of State Highway 16 would adversely affect the quality of these woodlands through the potential for soil compaction, erosion, and the encroachment of weedy species and the alteration of forest habitat.

Recreation

The 12.5 miles of the St. Croix National Scenic Riverway upstream of the hydroelectric dam are classified as "recreational" under the National Wild and Scenic River System. Management plans allow some man-made development in this section of the river. However, construction of a transmission line at this location could degrade the quality

of the river setting by creating a physical and visual intrusion in an otherwise undisturbed setting

Conclusions

Because of the potential for significant environmental and aesthetic impacts, the National Park Service and the U.S. Army Corps of Engineers (COE) have expressed serious concerns about the development of a new transmission crossing of the St. Croix River in this area. Although the proposed line would cross land adjacent to the river that is managed by the National Park Service, NSP would not need to negotiate a new easement for the line at this crossing. The COE, however, would require a Section 404 permit, under the Federal Water Pollution Control Act of 1974. In its role as a cooperating agency with other federal and state agencies, the COE has publicly stated its reluctance to issue a permit for a power line crossing at this location due to unresolved concerns about adverse impacts of the proposed line and the knowledge that development of a new infrastructure crossing is inconsistent with the St. Croix National Scenic Riverway Management Plan. When making permit determinations the COE and other state and federal agencies must compare the potential impacts of a transmission line crossing at this location with the potential harm of crossing at alternative crossing locations.

The Dam Crossing – Specific Environmental Characteristics

This proposed crossing for the new 230 kV transmission line is located about 0.5 mile north of the US Highway 8 bridge in a more urbanized setting than the northern or southern crossings. The cities of Taylors Falls, Minnesota, and St. Croix Falls, Wisconsin, lie north of the bridge on opposite sides of the river. A 69 kV line and two distribution lines cross the river directly below an NSP hydroelectric dam and generating plant. Together the highway bridge, the cities, the dam, the lines and a 69/12.4 kV substation on the Wisconsin side of the river, briefly disrupt, both visually and physically, the free-flowing character of the river.

Approximately 0.5 mile south of the dam, directly below the USH 8 bridge, the Dalles of the St. Croix, a series of sheer rock walls, create a narrow deep river gorge that recaptures the natural beauty of the river. The surface geology is primarily solid basalt rock and gravel below the hydroelectric dam.

On the Minnesota side of the river, the new 230 kV line would approach the dam and proposed crossing directly from the west regardless of which route is used between Taylors Falls and the Chisago Substation. In addition to the new 230 kV line, the 69 kV line that crosses the river here and extends east to the Apple River Substation would be rebuilt as part of this project. The 69 kV line would use the same corridor as the 230 kV line.

On the Wisconsin side of the river, several routing options for the 230 kV and 69 kV lines are possible. Boring one or both lines under the river would be very difficult due to space limitations and the extreme hardness of the basalt bedrock. A double-circuit 230/69 kV overhead crossing may not be the best design because the 69 kV line must connect to the substation adjacent to the hydroelectric plant, whereas the 230 kV line does not require such a connection.

An overhead line using a tubular steel H-frame structure on the Minnesota side and a 3-pole tubular steel angle structure on the Wisconsin side would span approximately 600 feet if built downstream of the dam. The cost estimate for an overhead crossing at this location would be the least expensive (about $165,000) and offer the simplest technical solution. A design that would accommodate separate overhead 230 kV and 69 kV lines downstream of the dam is currently being studied by the applicants.

HDD construction is technically feasible only downstream of the dam. The estimated cost of this solution ranges from $3,415,000 to $3,615,000. Trenching the line in downstream of the dam would include covering the conduit with river weights and sand-cement bags for protection. Estimated costs range from $2,912,000 to $3,049,000 depending on cable type (see Table 5-1.).

Aesthetics

The aesthetic concerns at this location are very different than at the other two proposed crossings. Many visitors to Interstate Park and the St. Croix Falls/Taylors Falls area are drawn by and attracted to the St. Croix River. The view of the river at the dam and hydroelectric plant, however, is primarily dominated by those facilities. The existing transmission and distribution wires are an expected extension of the dam and generating station. When viewed from a distance, the low profile of these facilities and the wooden structures allow the transmission and distribution lines to blend into the background. Use of taller or more massive structures would likely result in increased visibility of the lines. A section of the Ice Age Trail that winds along a ridge within the city of St. Croix Falls includes several vantage points from which the dam and existing electric lines are visible.

If this project is approved as proposed, the distribution circuits currently crossing the river would be removed and the 69 kV line would be rebuilt. If either the 230 kV or 69 kV circuits were placed underground in Minnesota or Wisconsin, one or more transition stations would be needed. Locating the transition structures to minimize their aesthetic and biological impact would be important. Because of the surrounding retail and residential development, use of this crossing would require a line design that would minimize the physical and visual intrusion of the conductors and structures.

In the past, a 34.5 kV line crossed the river just above the dam. The H-frame support structures are still in place on both sides of the river and the cleared ROW is still

evident on the Minnesota side. These support structures would be removed if both lines were installed downstream of the dam.

Archaeological Resources

Because the area immediately surrounding the dam and hydroelectric plant has been previously disturbed, there is no potential for direct impacts to archeological or historical resources associated with a transmission line or structures at this location. The State Historical Society of Wisconsin (SHSW) has indicated that it is possible that standing structures that may be eligible for listing on the National Register of Historic Places could be affected by the project if this crossing is used. The agency recommends that a qualified architectural historian survey the area of potential effect and submit a report to the SHSW. Potential impacts related to use of Segment JJ are discussed in Chapter 6.

Threatened and Endangered Species

In addition to one state-endangered mussel, the Snuff-box mussel (*Epioblasma triquetra*), two federally endangered species, the higgins-eye pearly mussel (*Lampsilis higginsii*) and the winged mapleleaf mussel (*Quadrula frugosa*) occur in the St. Croix River near the dam. In addition, several mussels listed as threatened in Minnesota occur in the river in this area. These mussels include: the mucket mussel (*Actinonaias ligamentina*), the elktoe mussel (*Alisidonta marginata*), the purple wartyback mussel (*Cyclonaias tuberculata*), the butterfly mussel (*Ellipsaria lineolata*), the monkeyface mussel (*Quadrula metanevra*), and the pistolgrip mussel (*Tritogonia verrucosa*). The gilt darter (*Percina evides*) and the blue sucker (*Cycleptus elongatus*), two state-threatened fish, and the lake sturgeon (*Acipenser fulvescens*), a special concern species, are also present in this section of the river.

Trumpeter swans, an endangered species in Wisconsin, have been observed migrating through this section of the river in spring and fall. It is possible that overhead lines at this location would pose a hazard for these birds during migration, however, placement of the lines downstream of the dam in a horizontal configuration on low-profile structures would minimize this hazard

Several species of rare dragonflies and plants occur along the shaded cliffs associated with the Dalles of the St. Croix directly below the USH 8 bridge. These species will be discussed in the route analysis of Chapter 6.

Wetlands

There are no wetlands adjacent to the river at this location. In Minnesota, a small wetland lies between USH 95 and the top of the riverbank. Placing a transition station or trenching an underground line through this area could disturb this wetland.

Recreation

Because of fluctuating water levels and strong currents, recreational activities directly adjacent to the dam are limited to fishing and passive activities related to watching river the river. Fishing opportunities would not be affected by the construction of a new transmission line. Although construction of an overhead or underground 230 kV line would alter the current view of the river at the dam, transmission lines at this location are an expected extension of the energy production activities related to the dam and the hydroelectric plant.

Conclusions

Construction of an overhead line at this location would be the least-cost design when compared with all other line designs and locations. Use of this proposed crossing would be more consistent with the Management Plan for the St. Croix National Scenic Riverway than use of either the southern or northern crossing. This location is an existing electric utility corridor. Because of the surrounding development and the presence of the dam, the hydroelectric plant and the substation, the addition of another line here would cause the least degradation of the scenic and recreational environment associated with the St. Croix River.

The South Crossing – Specific Environmental Characteristics

This proposed crossing is approximately three miles south of USH 8 in Section 2, T33N R19W. In Minnesota, the National Park Service owns and manages most of the land from the crest of the river valley down to the river. In Wisconsin, the land immediately abutting the river is privately owned, but the DNR owns and manages the eastern half of the SE ¼ of Section 2 as part of Interstate Park. The National Park Service has a scenic easement along both sides of the river.

After passing through the St. Croix Dalles directly south of the USH 8 bridge, the river slows and broadens again, winding around numerous sandbars and small islands. At the proposed crossing the main river channel is about 800 feet wide. A side channel along the east shore of the river opens into a narrow waterbody, creating a long peninsula that extends into the river. This peninsula supports lowland forest, consisting primarily of silver maple, green and black ash, and American elm. This area comprises the Interstate Lowland Forest, a designated State Natural Area. The sandbars, islands, and occasional sandstone cliffs common throughout this area of the Lower St. Croix River make this location one of the most popular sections of the river for recreational boaters.

The proposed transmission line would parallel two existing natural gas pipelines that cross the river diagonally from northwest to southeast. The two 24-inch pipelines,

owned by Viking Gas Company, a subsidiary of NSP, were installed using open trench construction in 1960. Only one of the pipes currently carries natural gas; the other was installed as a redundant system in case of failure. A cleared 75-foot wide ROW for the pipelines passes through woodlands adjacent to the river in Minnesota and Wisconsin. Viking Gas Company has an existing easement from the National Park Service for the pipeline. On the west side of the river, the pipeline ROW supports a low shrub cover. In Wisconsin, the ROW is mostly clear of brush, supporting a mixture of grasses and forbs.

Several line designs for the 230 kV line, including two overhead and one underground design, have been proposed for this crossing location. The ROW for two of the designs would likely overlap the existing gas pipeline ROW to some extent. The potential for corrosion of the pipelines due to the continuous presence of electric fields requires a minimum distance of at least 50 feet between the pipeline and the transmission line conductors. Placement of the transmission structures at the edge of the existing pipeline ROW would require an additional 40 to 50 feet of clearing at a minimum for an overhead line or an underground line that is trenched for some distance away from the river. A new easement would be required from the National Park Service, the DNR, and a private landowner if this crossing location were used.

Tubular steel H-frame structures would likely be used for an overhead crossing. If the line were bored under the river, the boring would have to avoid disturbance to the existing gas pipelines. Placement of the overhead structures or transition stations on or near the shoreline will be unacceptable to the National Park Service and Interstate Park managers. Placing the transition stations further from the river to minimize aesthetic impacts would increase the cost of both overhead and underground designs (see Table 5-1).

The South Crossing, Bluff to Bluff

Another option at the south crossing, would be to install the 230 kV transmission line underground from bluff to bluff, a distance of approximately 3800 feet. The installation method with the least surface impact would be horizontal directional drilling (HDD), but trenching could also be used. If installed underground, the transmission line would share a ROW with the existing Viking gas pipeline as much as possible. Utility consultants, Power Delivery Consultants, evaluated both HDD and trenching underground installation.

HDD or guided boring would require three bore holes spaced 50 feet apart and 40 feet below the river bottom. The 50-foot spacing is required because soil conditions under the river could cause the boring tool to stray as much as 20 feet in either direction from the design centerline. The wide spacing between cables would also reduce mutual heating effects and give each cable an increased current carrying capacity. The electrical circuits should be located at least 20 feet from the existing gas pipelines.

Cut and cover trenching would allow all three circuits to be placed 30 inches apart in one trench, with concrete fill, 36 inches below the river bottom. The consultant recommends that electrical lines be at least 50 feet from the existing gas pipelines.

A combination of HDD and trenching could also be used. If this were done, the entire underground distance would be 3500 to 3800 feet depending on the exact route. The 850-foot portion under the river would be installed using horizontal direct drilling while the portion going up the bluff on either side would be trenched in.

Aesthetics

Portions of the existing 75-foot wide gas pipeline ROW were designed to minimize adverse aesthetic impacts. The pipelines approach the river from the northwest and, at the west edge of the river, the pipelines bend slightly south. This slight bend effectively diminishes the ability to see a clear-cut path across the river from either shoreline or from any location on the river itself. Use of a similar ROW design has been discussed for an overhead or underground electric transmission line. Considerable tree trimming and removal would be required, with the width dependent on the distance required between the gas and electric facilities.

Because of the highly scenic quality of this section of the river, an overhead transmission line crossing at this location would be very undesirable. The long span length required to cross the main channel (about 850 feet) would result in structures approximately 115 to 120 feet tall. Shortening the span length across the main channel by placing a structure on the wooded peninsula would allow the use of low-profile structures and a horizontal wire configuration. A second span would then cross the side channel to the eastern shore. Depending on where the structures are placed on the peninsula, a significant amount of additional tree removal could be required. In addition to the potential adverse aesthetic impacts for boaters and canoeists on the river, the aesthetic experience of hikers and cross-country skiers using the Silverbrook Trail in Interstate Park would also be affected.

The spacing requirements for an underground 230 kV line, including the extra conductors for a redundant system, and the two existing natural gas pipelines would result in a 110-foot corridor through this sensitive area. Aesthetic impact of the 230 kV transmission line on the St Croix River Valley can be reduced by placing the line underground from bluff to bluff at the South Crossing. Locating the transition stations away from the shoreline to a point beyond the river bluffs would eliminate the visual impact of the towers and conductors. The transition stations could be placed west of the crest of the river valley in Minnesota and east of County Trunk S, beyond the Interstate Park boundary, in Wisconsin.

Archaeological Resources

An initial review of archeological and cultural resource literature completed by Thomas Pleger of the Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse indicates that there is a moderate to high potential for sites adjacent to the St. Croix River at this location. The SHSW has determined that a Phase I survey would be needed prior to beginning construction if this corridor is approved. Depending on the findings of this survey, a more detailed investigation could be needed.

Threatened and Endangered Resources

Many rare mussel species that could be adversely affected by a trenched or bored underground line occur in this section of the St. Croix River. These species include the federally endangered Higgins 'eye pearly mussel and winged maple leaf mussel. Four state-endangered species: the snuffbox mussel, the butterfly mussel, the purple wartyback mussel, and the spectacle case mussel (*Cumberlandia monodonta*) and three state-threatened species, the buckhorn mussel *(Tritogonia verrucosa*), the monkeyface mussel, and the salamander mussel (*Simpsonaias ambigua*) are also found in the area. Four special concern species, the elephant ear mussel (*Elliptio crassidens*), the elktoe mussel, the paper pondshell mussel *(Utterbackia imbecillis*) and the round pig-toe mussel *(Pleurobemia pyramidatum*) have also been observed in this section of the river.

Trumpeter swans, an endangered species in Wisconsin, have been observed migrating through this section of the river in spring and fall and some accounts have noted that the swans may rest and/or reside in this area for longer periods. Overhead lines could pose a hazard for these birds because of their flight habits during migration and their space requirements needed when taking off from the water surface.

Other species of concern that inhabit the shoreline or adjacent land and could be affected by an overhead or underground line include the Louisiana waterthrush *(Seiurus motacilla*), the acadian flycatcher (*Empidonax virescens*), the prairie fame flower (*Talinum rugospermum*) and a dragonfly, the St. Croix snaketail (*Ophiogomphus susbehcha*). The bald eagle and the timber wolf, two federally listed species, also occur in the area.

Wetlands

There are no wetlands present on the Minnesota or Wisconsin side of the river at this location. Depending on the placement of the line and the associated ROW, the Interstate Lowland Forest on the peninsula north of the existing pipeline ROW could be affected. Clearing bottomland forest in this riverine environment would likely result in a permanent grassy opening across the wooded peninsula. Because of fluctuating water levels and changing soil conditions, the regrowth of any woody vegetation, including shrubs and low growing trees, would be extremely slow.

Forests

The land directly adjacent to the river in Minnesota and Wisconsin is primarily upland forest consisting of mature aspen, oak, and maple. If the 230 kV transmission line is located at this crossing but placed within a separate ROW near the gas pipelines, a ROW about 110 feet wide would have to be cleared through the existing woodlands for an overhead or trenched underground line. (While a narrower ROW is sometimes allowed for an underground line, the applicants 'need to install redundant facilities would require a wider ROW.) If HDD installation is used to underground the line on upland areas, little or no new ROW clearing would be needed. Potential impacts would include loss of forest habitat in the ROW, soil compaction and erosion, and degradation of adjacent forest habitat due to the encroachment of weedy species from newly disturbed areas.

Recreation

This section of the St. Croix River is a prime destination spot for many river users in the area. The sandstone outcrops, diverse vegetation, small islands, and adjacent parkland provide a unique recreational opportunity for many activities such as hiking, canoeing, floating and picnicking. The presence of an overhead line would be an intrusion in an otherwise undeveloped setting. In fall and winter after the leaf fall, the line would also be visible to hikers and cross-country skiers using the trails in Wisconsin Interstate Park. Underground installation, especially bluff to bluff, would minimize the visual intrusion substantially.

The activities associated with trenching a high voltage line across the river would likely result in closing of this portion of the river to recreational use for a period of several weeks to a month.

Conclusions

This portion of the St. Croix National Scenic Riverway is classified as "scenic." Although a new transmission line across the St. Croix River at this location would share corridors with an existing gas pipeline, an overhead line at this crossing would be inconsistent with management planning for the Riverway. The visual effects of an underground transmission line might be less intrusive than an overhead crossing, but the potential construction impacts associated with boring or trenching a high-voltage line under the river and the long-term impacts associated with the power line ROW would remain.

Chapter 6

Chapter 6 - Project Route Alternatives in Wisconsin

This chapter describes the route alternatives in Wisconsin for the proposed Chisago Electric Transmission Line Project. Included are route options for building a new 230 kV transmission line and rebuilding the existing 69 kV transmission line. The project area in Wisconsin extends from the St. Croix River to the Apple River Substation near Amery. To more easily describe the route alternatives, the project area has been divided into two sectors, the St. Croix sector and the Apple River sector. The St. Croix sector is the area between the St. Croix River and Segment SS (near 208th Street), and the Apple River sector is the area from Segment SS east to the Apple River Substation.

The three possible river crossing locations (see Chapter 5) and two options for routing the 69 kV and 230 kV line through the city of St. Croix Falls result in a total of five route alternatives in the St. Croix sector. There are three route alternatives in the Apple River sector. Any of the routes in the St. Croix sector could be combined with any route in the Apple River sector.

The topography and land use in each of the sectors and more detailed information about each of the route alternatives are described below. A map of each route alternative is also shown. The information about each route alternative includes:

- A proposed line design (ROW width, pole type and height, span length) for each section of the route.
- The potential environmental impacts associated with the route alternative.
- The cost of each alternative.
- A route map with segment labels.
- The St. Croix Sector – Existing Environment

Topography

The landscape and landforms in this portion of the project area were strongly influenced by glaciation and the erosive action of the St. Croix River. Long moderate slopes begin at the shoreline of the river and rise eastward before leveling off about one mile from the river. Many ridges consisting of glacial sand deposits are present throughout the area, but are especially evident in the city of St. Croix Falls and south of USH 8 in Interstate Park. Much of the area between the crest of the river valley and Segment SS (near 208th Street) is comprised of rolling terrain interspersed with shallow depressions.

Soils

The St. Croix sector contains many areas along the river where significant slopes and exposed bedrock are prominent. In the northern portion of this sector, some poorly drained and very poorly drained soils subject to frequent flooding are present adjacent to the river. The soils in upland areas are generally sand, loamy sand, or gravelly sand. Scattered shallow depressions in these areas often contain fine sands that although droughty much of the year, may have a seasonally high water table.

Plant Communities

This sector contains more woodland than the area further to the east. In upland areas these woodlands contain a mixture of conifers and deciduous hardwoods and are dominated by oaks, maple, aspen, and white pine. Adjacent to the St. Croix River, areas of bottomland hardwoods dominated by green and black ash, elm, and silver maple are present. Open upland areas that are not actively farmed generally consist of old field vegetation dominated by grasses and weedy species. The scattered seasonally wet depressions found in upland areas often support emergent vegetation or wet meadow species.

Land Use

The city of St. Croix Falls and the commercial development bounding USH 8 from the river east to Segment SS (located just east of 208th Street) are the principal urbanized areas in this sector. Large areas north and south of the city are forested, including the majority of Interstate Park. Interstate Park is one of the most popular state parks in Wisconsin offering nearly 100 individual camp sites, two group sites, a rock-climbing area, and about 10 to 11 miles of hiking and cross-country ski trails. The park, the St. Croix National Scenic Riverway, and numerous small lakes in the project area attract visitors from throughout the region and the Minneapolis/St. Paul metropolitan area. Further to the east in this sector along Segment SS, many dairy farms are present. Although agriculture is a dominant land use in the area, the farms are generally smaller than those found in central and southern Wisconsin

Table 6-1 St. Croix Sector Route Alternatives

	Dam-Louisiana-Washington	Dam-Washington Louisiana	Dam-Double Washington	North-Washington	South-Washington
Total Length	11.2 miles	10.7 miles	7.90 miles	17.3 miles	9.6 miles
ROW new (80-100') widen (20-50') no change	 0 miles 3.5 miles 7.7 miles	 0 miles 7.3 miles 3.4 miles	 2.0 miles 5.9 miles 0 miles	 9.9 miles 0 miles 6.4 miles	 3.5 miles 2.9 miles 3.2 miles
Percent corridor-sharing	100%	100%	100%	37%	69%
Type of corridor-sharing (miles)	4.8 Road 6.4 T-line	5.6 Road 4.8 T-line 0.4 D-line	1.8 Road 4.1 T-line	6.4 T-line	6.6 T-line
Existing facilities at river crossing	Dam and existing 69 kV transmission and distribution lines	Dam and existing 69 kV transmission and distribution lines	Dam and existing 69 kV transmission and distribution lines	None	Underground gas pipeline
Estimated Cost	$6,279,000	$5,494,000	$7,890,000	$5,435,000	$4,288,000
Homes within 100 ft.	50	56	29	30	29
Homes within 300 ft.	128	132	60	63	60
Comm./Indus. Within 300 ft.	18	21	8	8	8
Public facilities within 300 ft.	2 schools 2 park 1 nursing home 1 playground	2 schools 2 parks 2 nursing homes 1 playground	 1 park 1 nursing home	 1 park 1 nursing home	 1 park 1 nursing home
Primary Impacts	Short-term construction impacts for city residents. Aesthetic impact associated with transition structures.	Additional ROW and potential adverse impacts on homes on South River Street	Additional ROW width and potential adverse aesthetic impacts for double-circuit sections	Previously undisturbed river crossing. New cross-country ROW across forests and farmland and wetlands for 230 kV line	New ROW at the river crossing and across Interstate Park land causing incremental impacts on aesthetics and forest resources.

The St. Croix Sector – Route Alternatives

As mentioned earlier, there are five route alternatives in this sector. A summary of the alternatives is found in Table 6-1, followed by more detailed information for each route.

The Dam-Louisiana-Washington Route

Description

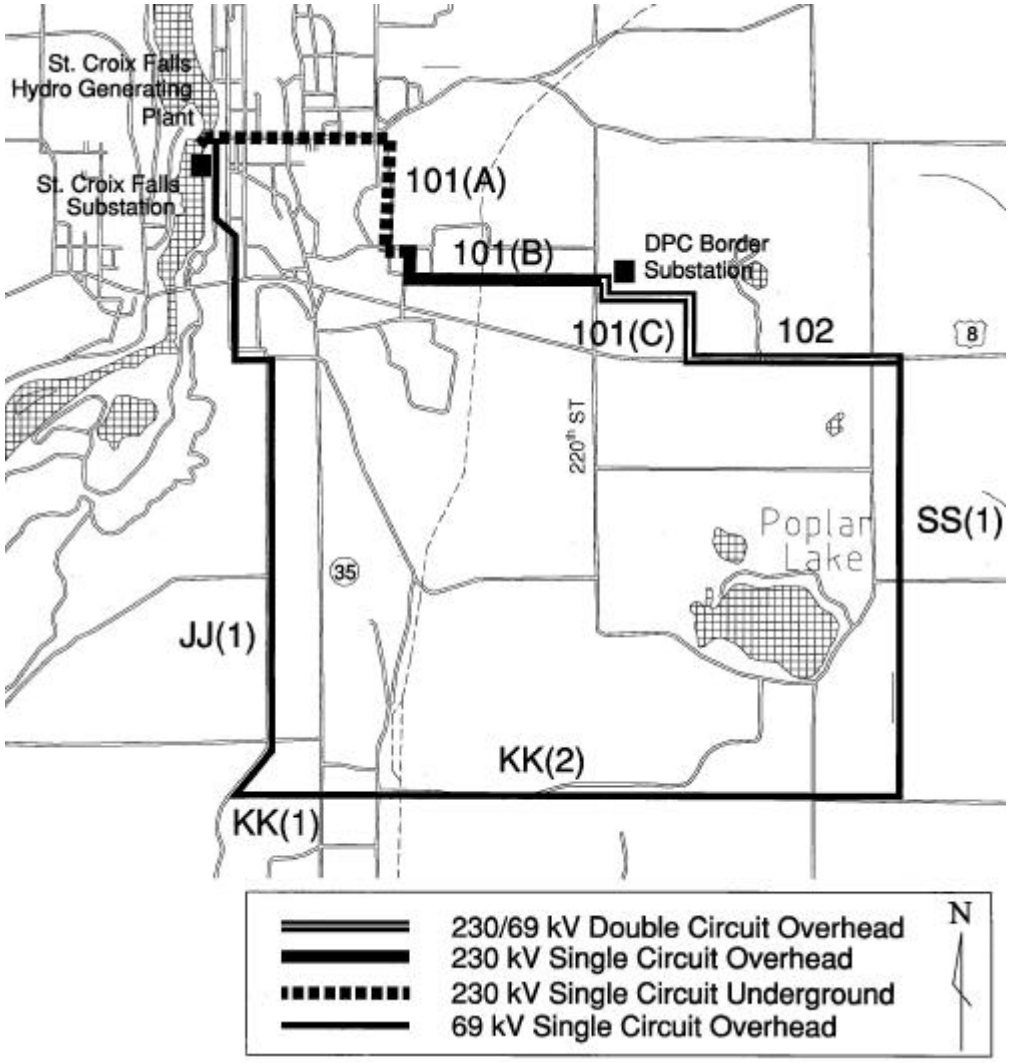
The Dam-Louisiana-Washington Route begins at the hydroelectric dam in the city of St. Croix Falls and places the existing 69 kV and the new 230 kV line on separate rights-of-way (see Figure 6-1). The 230 kV line would be routed underground on Louisiana Street to Blandings Wood Road, then south on Blanding's Wood Road to East Pine Street and then overhead going east on Pine Street to DPC's Border Substation. From the substation, the 230 kV line would be double-circuited with an existing DPC 69 kV line to USH 8. At USH 8, the 69 kV line would continue south along its existing ROW and the 230 kV line would parallel USH 8 eastward to Segment SS (near 208th Street).

The transition structures required to change the 230 kV line from an overhead to underground design would be placed adjacent to the hydroelectric plant. Boring or trenching would be used to install the line from the transition structures to the base of Louisiana Street. The underground 230 kV line on Louisiana Street and Blandings Wood Road would be located under the pavement in the street adjacent to existing sewer and water utilities. The applicants have stated that redundant facilities, that is, two sets of three conductors would be installed wherever the 230 kV line is underground. This redundancy is required due to the lower capacity of underground cables and the additional time needed to locate and repair a fault in a buried line should one occur. At or near the intersection of East Pine Street and Blandings Wood Road, another set of transition structures would be needed to convert the underground line to an overhead design.

Some corridor-sharing with existing facilities would be possible. The overhead 230 kV line on Pine Street would be placed within an existing distribution line ROW. From the Border Substation east and south toward USH 8, the 230 kV and DPC's existing 69 kV line would be double-circuited within an existing 69 kV line ROW.

NSP's 69 kV line that presently crosses the river at the dam would be rebuilt on its existing ROW on wood poles from the hydroelectric dam in St. Croix Falls to Segment SS. A route modification that involves relocating a section of line that currently passes through Interstate Park to Highway 35 is under consideration.

Figure 6-1 Map of the Dam-Louisiana-Washington Route



A description of the line voltage, proposed structure type, height, and ROW width for the segments in the Dam-Louisiana-Washington Route is shown in Table 6-2.

Table 6-2 The Dam-Louisiana-Washington Route

Segment	Line Design						
	Length (miles)	ROW width (feet)	Voltage (kV)	Structure Material	Structure Type	Pole Height (feet)	Span Length (feet)
101A	1.34	street width	230	U.G.	U.G.	U.G.	U.G.
101B	1.86	60	230	Steel	Braced HLP*	62	450
101C	0.60	60	230/69	Steel	I-string*	65	450
102	1.00	100	230/69	Steel	I-string	100-140	650
SS_1**	2.00	100	230/69	Steel	I-string	100-140	650
JJ	1.45	60	69	Wood	HLP	65-75	300-400
JJ_1	1.5	60	69	Wood	HLP	65-75	300-400
KK_1	0.5	60	69	Wood	HLP	65-75	300-400
KK_2	2.7	60	69	Wood	HLP	65-75	300-400

* These would be a low-profile steel pole as shown in Figure D-1and D-3.

** This segment would not be needed if the Split Route in the Apple River Sector were used.

Agricultural Impacts

Potential impacts to farmland could occur during reconstruction of the 69 kV line at the east end of the St. Croix sector along Segment SS and along USH 8 east of 208th Street. On USH 8, pole placement would be along field edges outside of the road ROW and minimal impact on agricultural operations would be expected.

Segment SS is a cross-country route that runs along a quarter section line and property boundaries. (This segment is not needed if the 230 kV line is routed east on USH 8 in the Apple River Sector.) Hay and corn are the most commonly grown crops in this area. The 230 kV line would be built on steel braced HLP poles with a span of about 650 feet between poles. Depending on when construction would occur, soil compaction, crop damage, and interference with farming operations are possible. Constructing the line during a time period outside of the growing season when soils are frozen or dry would greatly minimize or eliminate these impacts.

Forest Impacts

Little additional ROW would need to be cleared through forested areas for either the 230 kV or 69 kV line. The 69 kV line passes through the city along city and town roads. Within the state park, the existing 69 kV line extends south paralleling a maintenance road. No additional clearing would be needed in the park. If the 69 kV line is moved to Highway 35, a portion of the ROW would overlap the road and about 20 to 35 feet of additional ROW would need to be cleared in areas where there are now trees adjacent to the road. The area on the east side of the highway is mostly wooded between CTH S and Ravine Drive. Northern mesic forest species, such as northern red oak, basswood, and sugar maple are dominant in this area.

Red oak, in addition to other species in the red oak family (black oak and northern pin oak), is highly susceptible to oak wilt disease. This disease has a high mortality rate, often resulting in death within one year of initial infection. The primary cause of the disease is a fungus that can be carried between trees by sap-feeding beetles or spread to adjacent trees through interconnected root systems.

Spread of this disease to healthy trees is possible by wounding, pruning, or removing trees in the ROW during construction or maintenance, especially during spring or early summer when the beetles are active and the fungi are producing spores. These activities can also accelerate the spread of the disease if it is already present in the area. If this route alternative is used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

The Dresser quarry operations are screened to some extent from Highway 35. Additional tree removal on the east side of the road could increase the visibility of the quarry from the road.

Stream Crossings and Wetland Impacts

After crossing the St. Croix River, the 230 kV line would not cross any additional rivers, streams, or wetlands as it continues east to Segment SS. Jerusalem Pond is located adjacent to Blandings Wood Road and the bedrock is very close to the surface in this area. Boring or trenching the 230 kV line in this road or along the property line between the high school and the homes on the west side of Blandings Wood Road could require special construction techniques to avoid adversely impacting Jerusalem pond or any underground springs or flows associated with the pond.

On Segment SS south of USH 8 and near the intersection of Segment SS and Segment KK on 110th Avenue, the 69 kV line crosses several wetlands consisting primarily of cattails and reed canary grass. These areas are relatively small and could be spanned by the line. If replacement of the existing poles and conductors could be done with construction equipment confined to the roadway, impacts to the wetland vegetation and soils would be minimal.

Endangered/Threatened Resources

A review of the Natural Heritage Inventory indicates that there are no known occurrences of state-listed threatened or endangered species along this route. Bald eagles occur in this area; timber wolves and Karner blue butterflies may also be present. These are federally listed species. If no modifications to the existing 69 kV alignment are made, no impacts to these resources would be expected.

Aesthetic Impacts

Crossing the St. Croix River at the hydroelectric dam would have the least visual impact of any of the three proposed crossings. The dam, power house, and existing

transmission and distribution wires create an "urbanized" setting that could more readily assimilate the addition of another transmission line than the undisturbed areas north and south of the city.

Within the city of St. Croix Falls, the primary adverse visual impact would be the transition structures located near the dam and in the Industrial Park. No tree trimming or removal would be needed along city streets adjacent to the underground portion of the line. A section of the Gandy Dancer Bike Trail passes through the industrial park and the overhead portion of the 230 kV transmission line would cross the trail as the line runs east along Pine Street. This portion of the city presently contains existing commercial development, two water towers and a radio tower. The line would have an incremental adverse visual impact in this area. Further east along USH 8, the 230 kV line would be highly visible to drivers traveling on the highway but, due to the commercial setting along USH 8 in this area (west of 208th Street), the aesthetic impact of the line would be minimal.

The physical appearance of the 69 kV line should not change greatly when it is rebuilt. It is likely that a horizontal line post design would be used (see structure diagrams in Appendix D) resulting in a narrower profile than the current design. Existing distribution lines would be underbuilt on the new transmission line structures. Pole height (65 to 75 feet) and span length (about 300 to 400 feet) would remain approximately the same. Segment KK also crosses the Gandy Dancer Bike Trail, but little change in the appearance of the 69 kV line would occur.

Socioeconomic Impacts

The visual impact of the line could be minimized if low-profile structures with the wires in a horizontal configuration were used to approach the river in Taylors Falls and cross the river immediately below the dam at the hydroelectric plant. On the Wisconsin side the transition structures would be placed in an area adjacent to the power plant that presently contains the substation, a small parking area, and many poles, braces and distribution lines.

Use of this route alternative would not be expected to have much impact on the use and enjoyment of the St. Croix River, property values in St. Croix Falls and the surrounding area, or the general economy of the area. Undergrounding the 230 kV line would greatly reduce the visual impact of the line within the city and the rebuilt 69 kV line would remain largely unchanged. Within the city limits, there would be little change in the appearance of the neighborhoods or the business district.

Magnetic field levels associated with the underground line would decrease rapidly with distance from the line. EMF levels within 50-100 feet of the centerline would be similar to or lower than background levels found in typical residences (see the EMF discussion in Chapter 4 and estimated EMF levels in Table 4-2).

The city has plans to upgrade city utilities on Louisiana Street and repave Blandings Wood Road over the next several years. If the 230 kV or 69 kV transmission line were buried in the street while doing this work, the city could potentially recover some of its costs.

Historical and Archeological Impacts

Use of this alternative would not be expected to impact any known historical or archeological resources. Homes or commercial buildings on South River Street or Washington Street would not be adversely affected since no additional ROW would be required for rebuilding the 69 kV line.

The State Historical Society of Wisconsin (SHSW) has indicated that it is possible that standing structures which may be eligible for listing on the National Register of Historic Places could be affected by the project. The agency recommends that a qualified architectural historian survey the area of potential effect and submit a report to the SHSW.

Recreational Impacts

As mentioned previously, the 230 kV line would cross the section of the Gandy Dancer Bike Trail that passes through the Industrial Park. Due to other visual distractions in the immediate area, the line could have an incremental adverse effect on the use or enjoyment of the trail.

A six-year development plan for Interstate Park includes the addition of another 100-unit campground. This campground would be built adjacent to the maintenance road south of the park entrance area. If this development occurs, the presence of the 69 kV line may become a physical and visual intrusion in a heavily used recreational setting. A permanent relocation of the line from the park to Highway 35 would be a reasonable solution.

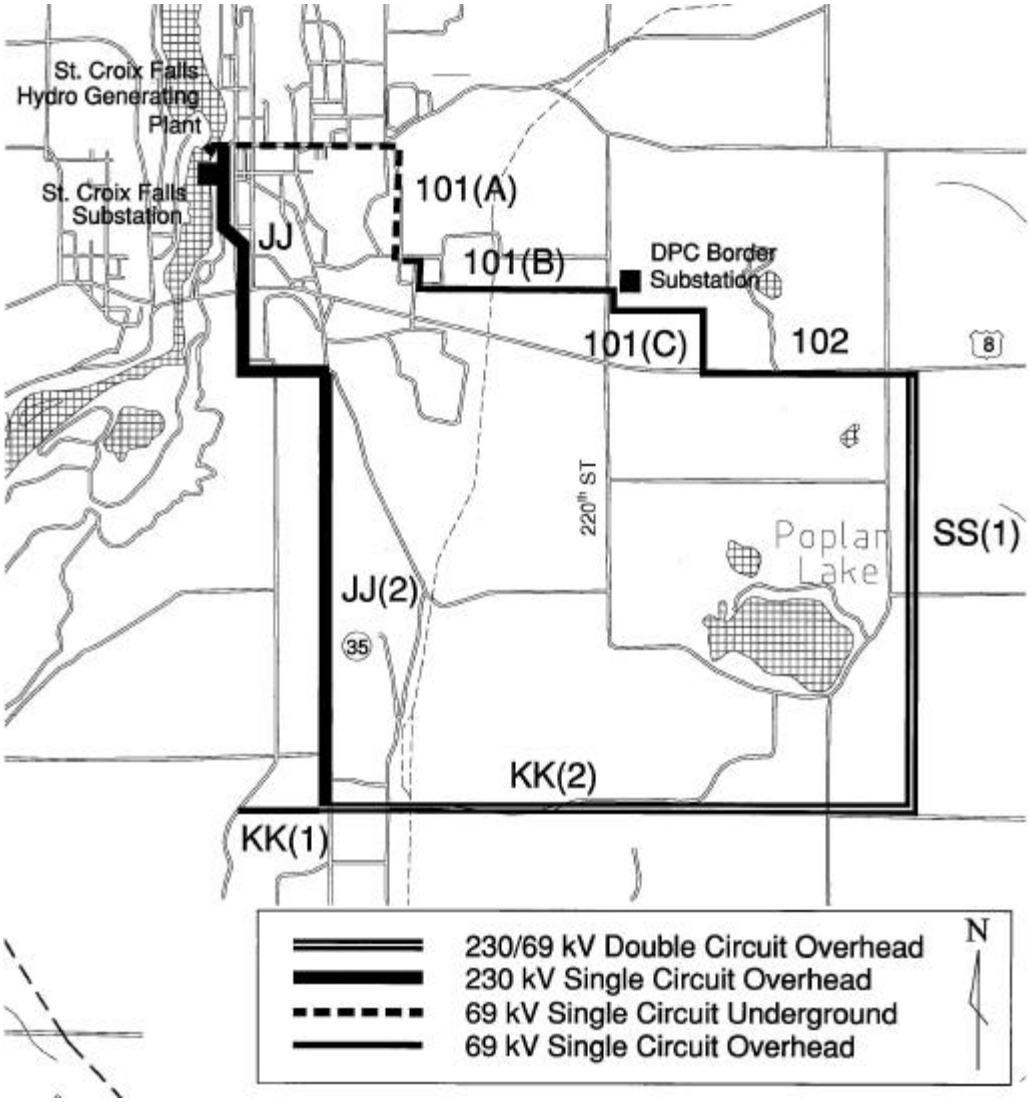
The Dam–Washington-Louisiana Route

Description

The Dam-Washington-Louisiana Route shown in Figure 6-2 is identical to the route described above, except that the locations of the 69 V line and the 230 kV line are reversed. The 69 kV line would be underground on Louisiana Street and Blandings Wood Road, while the 230 kV line would be built as an overhead line within the existing 69 kV line ROW along South River Street, Washington Street, and behind the homes on Connecticut Avenue. It is likely that the 230 kV line would be routed along Highway 35 rather than on the existing 69 kV alignment (adjacent to the maintenance road) through Interstate Park. To reach Highway 35 a new section of ROW would be needed along the northern boundary of the state park or on private property on McKenney Street.

Where the 69 kV line would become an overhead line at Pine Street in the city of St. Croix Falls, existing distribution lines in the same corridor would be underbuilt on the transmission line poles.

Figure 6-2 Map of the Dam-Washington-Louisiana Route



A description of the line voltage, proposed structure type, height, and ROW width for the segments in the Dam-Washington-Louisiana Route is shown in Table 6-3.

Table 6-3 The Dam-Washington-Louisiana Route

Segment	Line Design							
	Length (miles)	ROW Width (feet)	Voltage (kV)	Structure Material	Structure Type	Number of Circuits	Span Length (feet)	Pole Height (feet)
101A	1.34	street width	69	U.G.	U.G.	One	U.G.	U.G.
101B	1.86	60	69	Wood	HLP	One	350	55-80
101C	0.60	60	69	Wood	HLP	One	350	55-80
102	1.00	60	69	Wood	HLP	One	350	55-80
SS_1*	2.00	60 or 100	69 or 230/69	Wood or Steel	HLP or I-string	One or Two	350 or 650	55-80 or 100-140
JJ	1.45	60	230	Steel	Braced HLP **	One	450	62
JJ_2	1.75	75	230	Steel	I-string	One	900	85-120
KK_2	2.70	100	230/69	Steel	I-string	Two	650	100-140

* This segment would be a double-circuit 230/69 kV line if the Split Route is used in the Apple River Sector. If any other route were used, SS_1 would be a single circuit 69 kV line.

a**The 230 kV line within the city of St. Croix Falls would use low-profile structures (Figure D-1) designed to minimize the aesthetic impacts associated with high voltage lines. Due to the lower height of the poles, the distance between structures would be less than if taller structures were used. Adjacent to Highway 35, taller structures with a longer span length between poles may be more effective in minimizing aesthetic impacts.

Some changes in the existing 69 kV system that services the St. Croix Falls –Dresser area would also be needed if this alternative were used. At the present time, NSP's 69 kV line extending north from Dresser taps the existing 69 kV line near the southern end of Segment JJ_1. A single circuit 69 kV line proceeds east to the Sand Lake Substation. For this route alternative, no tap would be needed. The 69 kV line from Dresser would continue east to the Sand Lake Substation. It would be built as a double-circuit with the 230 kV line along Segment KK_2.

Agricultural Impacts

The potential agricultural impacts would be the same as previously described for the Dam-Louisiana-Washington Route. Segment SS_1 or DPC's existing 69 kV line ROW extending east and south from the Border Substation could be used to extend the 69 kV line south across USH 8 toward the Sand Lake Substation. Hay and corn are the most commonly grown crops in this area. The 69 kV line would be built on wood HLP poles with a span of 300 to 400 feet between poles. Depending on when construction would occur, soil compaction, crop damage, and interference with farming operations are possible. Constructing the line during a time period outside of the growing season when soils are frozen or dry would greatly minimize or eliminate these impacts.

Forest Impacts

Much of the southern half of Segment JJ_2, along Highway 35, is forested. Northern red and bur oak mixed with aspen are dominant. If the 230 kV line were placed on Segment JJ_2, the transmission line poles would likely be placed at the edge of the highway ROW. This could require removal of an additional 20 to 30 feet of trees to provide the needed clearance for the line.

Establishment or accelerated spread of oak wilt disease (as described earlier in this chapter) could result from trimming or wounding of oak trees in the spring or early summer when the beetles are active and the fungi are producing spores. If this route alternative is used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

Stream Crossings and Wetlands

After crossing the St. Croix River, the 69 kV line would be converted to an underground design before continuing up Louisiana Street and east to Segment SS. Jerusalem Pond is located adjacent to Blandings Wood Road and the bedrock is very close to the surface in this area. Boring or trenching the 69 kV line in this road or along the property line between the high school and the homes on the west side of Blandings Wood Road could require special construction techniques to avoid adversely impacting the pond or any underground springs or flows associated with Jerusalem Pond.

On Segment SS_1 south of USH 8 and near the intersection of Segment SS_1 and Segment KK_2 on 110th Avenue, the 230 kV line would cross several wetlands consisting primarily of cattails and reed canary grass. These areas are relatively small and could be spanned by the line. If the new poles and conductors could be installed with construction equipment confined to the roadway, impacts to the wetland vegetation and soils would be minimal.

Endangered/Threatened Resources

A review of the Natural Heritage Inventory indicates that there are no known occurrences of state-listed threatened or endangered species along this route. Bald eagles occur in the area and timber wolves and Karner blue butterflies could also be present. These three species are federally listed species. A more detailed survey for these species would be recommended if this route alternative is approved.

Aesthetic Impacts

Adverse visual impacts associated with placing the 69 kV line underground and rerouting it along Louisiana Street, Blandings Wood Road, and East Pine Street would be minimal. The transition structures used to convert the 69 kV line from an overhead

to underground design would not be noticeably larger than the rest of the 69 kV structures.

The line design used for the 230 kV line within the city of St. Croix Falls would be a low-profile design that would keep the transmission line in scale with its surroundings. To support the size of the conductors and insulators needed, the structures would be stockier than those used for the existing 69 kV line. This low-profile design would be used on South River Street, Washington Street, and behind the homes on Connecticut Street and McKenney Road. Taller structures with longer span lengths would likely be used along Highway 35 and on Segment KK_2.

Several homes and businesses would be affected if the line were routed on the west side of Highway 35. If routed on the east side of Highway 35, line clearance requirements could result in the trimming or removal of trees around homes near the north end of Segment JJ_2. Near the intersection of Highway 35 and Ravine Drive, a 69 kV NSP line from Dresser would join the 230 kV line. The two lines would be double-circuited on the existing 69 kV line ROW to the Sand Lake Substation.

Socioeconomic Impacts

Impacts expected would be similar to those described above for the Dam-Louisiana-Washington Route although the wider ROW width needed for an overhead 230 kV line along Washington Street would likely require acquisition of additional easements in the city of St. Croix Falls. New easements would be needed at the northern edge of Interstate Park or McKenney Road and along Highway 35.

The ROW for the existing 69 kV line on Washington Street is 50 feet wide; NSP maintains a clear area of about 25 feet on each side of the poles. If the 69 kV line is rerouted to Louisiana Street and the 230 kV line is placed on the existing 69 kV center line, an additional 15 to 20 feet of ROW on each side of the 230 kV structures would likely be needed.

At this time it is not known if the applicants would need to purchase and remove some homes in St. Croix Falls to provide adequate code clearance for the 230 kV single circuit structures. A detailed line design is needed before that determination could be made and would depend on the location of the structures, the amount of conductor "blowout" and the location of the homes. In addition, special transmission line structures could possibly be developed to avoid the need to relocate any homes. The applicants would make every attempt to avoid relocation of residences when designing and locating the transmission line structures.

The city has plans to upgrade existing utilities on Louisiana Street and to resurface Blandings Woods Road over the next several years. If the 69 kV transmission line were buried in the street while doing this work, the city could potentially recover some of its costs.

Historical and Archeological Impacts

If there would be a need for the applicants to purchase and remove any homes on South River Street, the historical significance of these homes would have to be assessed. The State Historical Society of Wisconsin (SHSW) has indicated that it is possible that standing structures which may be eligible for listing on the National Register of Historic Places could be affected by the project. The agency recommends that a qualified architectural historian survey the area of potential effect and submit a report to the SHSW.

It is not expected that the 230 kV line would be significantly taller or more obtrusive than the existing 69 kV transmission line, however, the low-profile 230 kV line design could have an adverse visual impact on these properties due to its stockier appearance and longer conductors.

Although there are numerous archeological sites located within Interstate Park, if the 230 kV line is built entirely within the existing 69 kV ROW, no adverse impacts on these resources would be expected. If the 230 kV line were extended across the northern edge of park property to Highway 35 and then placed adjacent to the highway, a Phase I archeological survey would likely be required before construction occurs.

Recreational Impacts

The 69 kV line would cross the section of the Gandy Dancer Bike Trail that passes through the Industrial Park. Due to other visual distractions in the immediate area, and the relatively small stature of the line, it would likely have a negligible adverse effect on the use or enjoyment of the trail. The 230 kV line would also cross the Gandy Dancer Trail (on Segment KK_2). Trail users may notice the wider ROW and the larger steel structures.

A six-year development plan for Interstate Park includes the addition of another 100-unit campground. This campground would be built adjacent to the maintenance road south of the park entrance area. If this development occurs, the presence of a 230 kV line would be an inappropriate physical and visual intrusion in a heavily used recreational setting. A permanent relocation of the line from the park to Highway 35 would be a reasonable solution.

The Dam-Double Washington Route

Description

The Dam-Double Washington Route, shown in Figure 6-3, would place both lines within the existing 69 kV line ROW, one overhead and the other underground. It is likely that the 69 kV line would be placed underground rather than the 230 kV line, due to greater ease of construction and lower construction costs. The north-south portion of the existing 69 kV line would be removed from Interstate Park and a double-circuit

overhead 230/69 kV line would be built adjacent to Highway 35 on Segment JJ_2 and east on Segment KK_2. The existing 69 kV line ROW behind homes on Connecticut Street would be extended along the northern park boundary or on private property on McKenney Street to Highway 35.

An additional 20 to 30 feet of ROW would be needed for the portions of the line that are within the existing 69 kV line corridor. New ROW easements would be needed to extend the line east to Highway 35 and south along the highway.

Within the city of St. Croix Falls, the existing distribution lines along Washington Street would be placed underground or underbuilt on the new transmission structures.

A description of the line voltage, proposed structure type, height, and ROW width for the segments in the Dam-Double Washington Route is shown in Table 6-4.

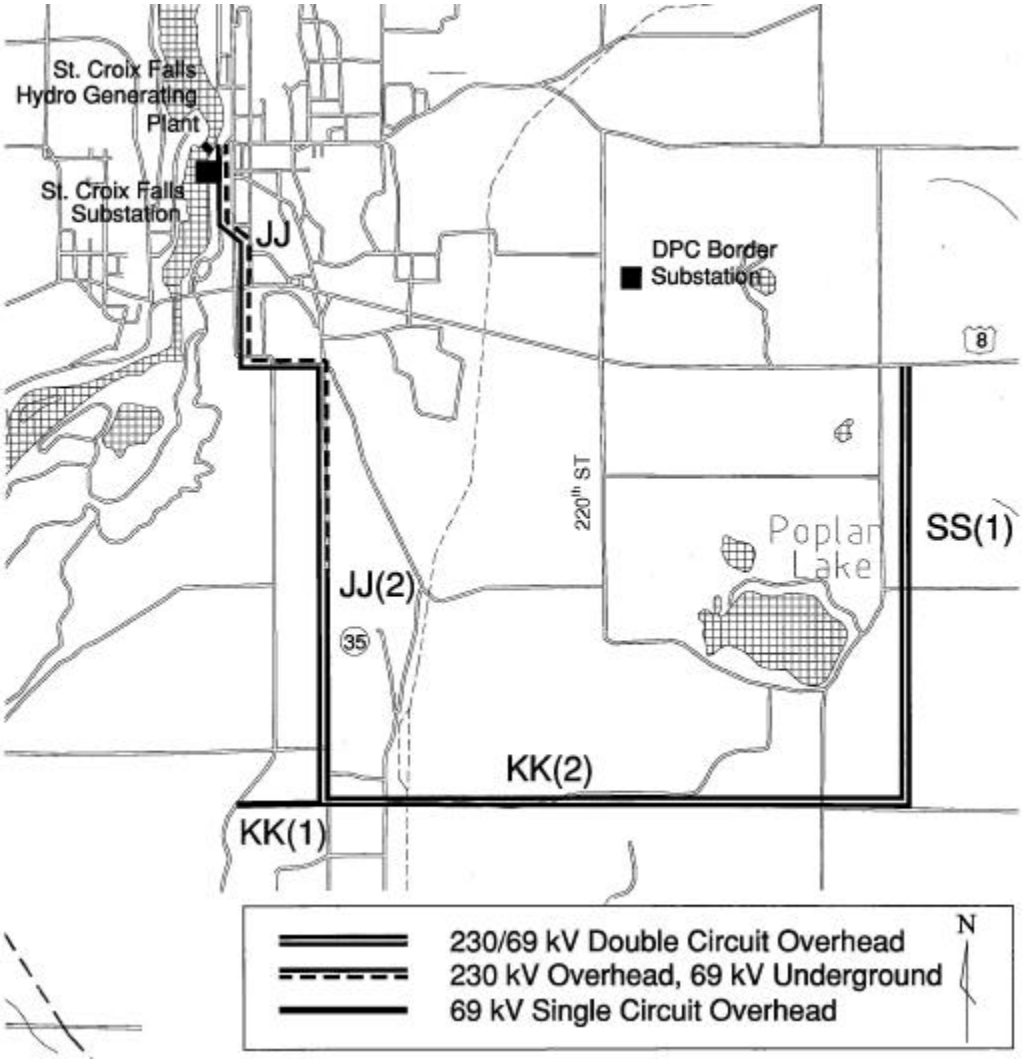
Table 6-4 The Dam-Double Washington Route

Segment	Line Design							
	Length	ROW	Voltage	Structure	Structure	Number	Span	Pole
JJ (city)	1.45	60	230 69	Steel U.G.	Braced HLP* U.G.	One One	450	62
JJ_2	1.75	100	230/69	Steel	I-string	Two	650	100-140
KK_2	2.70	100	230 /69	Steel	I-string	Two	650	100-140
SS_1**	2.00	100	230/69	Steel	I-string	Two	650	100-140

* The structure type used for the 230 kV line within the city of St. Croix Falls would be a low-profile structure designed to minimize the aesthetic impacts associated with a high voltage line. Due to the lower profile, the distance between structures would be less than if taller structures were used. Adjacent to Highway 35 between McKenney Road and Trap Rock Road, taller structures with a longer span between poles may be more effective in minimizing aesthetic impacts.

** SS_1 would only be needed if the Split Route were used in the Apple River Sector. The 230 kV line would be double-circuited with DPC's 69 kV line from the Border Substation.

Figure 6-3 Map of the Dam-Double-Washington Route



Agricultural Impacts

The greatest potential for impacts to agricultural areas on this route would occur at the eastern end of the St. Croix sector along Segment SS where the 230 kV transmission line would run cross-country on a quarter section line. (The 230 kV line would only be built on this segment if it were routed along USH 8 east of Segment SS.) The poles would be steel I-string structures with a span length of approximately 650 feet. Expected long-term impacts on field operations should be minimal. Central pivot irrigation and aerial spraying are not commonly used in this area of the state. Adverse effects of construction on soils and crops could be avoided or minimized if construction occurs during the time outside of the growing season when soils are frozen or dry.

Forest Impacts

The additional ROW needed if both the 230 kV and 69 kV lines are built within the existing easement will require the removal of about 20 to 30 feet of trees wherever the lines pass through wooded areas. The southern section of Segment JJ_2 and half of Segment KK are forested. Dominant tree species are red oak, bur oak, maple, and aspen.

Establishment or accelerated spread of oak wilt disease (as described earlier in this chapter) could result from trimming or wounding of oak trees in the spring or early summer when the beetles are active and the fungi are producing spores. If this route alternative is used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

Stream Crossings and Wetland Impacts

After crossing the St. Croix River, this route alternative would not affect any other streams, rivers, or water bodies. A small wetland located near the intersection of Segments KK and SS could probably be spanned by the double-circuit line. If construction can be done with equipment confined to the roadway, impacts to the wetland vegetation and soils would be minimal.

Endangered/Threatened Resources

A review of the Natural Heritage Inventory indicates that, with the exception of the species present in the St. Croix River corridor, there are no known occurrences of state-listed threatened or endangered species along this route. Bald eagles have been observed in the area and timber wolves and Karner blue butterflies may also be present. These three species are federally listed. A more detailed survey for these species would be recommended if this route alternative is used.

Aesthetic Impacts

The line would be designed and routed to minimize visual impacts within the city of St. Croix Falls and Interstate Park. If the 69 kV line is placed underground, the 230 kV line would be placed on low-profile structures within the city limits to keep the pole height in scale with surrounding development. However, the diameter of the poles would be wider than the existing structures for the 69 kV line and the conductors would be longer. If the 230 kV line is placed underground and the 69 kV line is built overhead, the visual impact of the line would remain largely unchanged. However, more tree trimming or removal may be necessary to accommodate the wider ROW width needed for the two or three 230 kV circuits needed (see the discussion about redundant systems for underground designs in Chapter 5).

The additional ROW required for a double-circuit overhead 230/69 kV line would likely require removal of 20 to 30 feet of trees along Highway 35 and Segment KK.

This clearing and the increased size of the line could have an adverse visual impact for travelers using the highway and property owners on Ravine Drive.

Socioeconomic Impacts

The wider ROW width needed for an overhead 230 kV line would likely require acquisition of additional easements in the city of St. Croix Falls, at the north end of Interstate Park and along Highway 35.

At this time it is not known if the applicants would need to purchase and remove any homes in St. Croix Falls to provide adequate code clearance for the 230 kV single circuit structures. A detailed line design would be needed before that determination could be made and would depend on the location of the structures, the amount of conductor "blowout" and the location of the homes. In addition, special transmission line structures could possibly be developed to avoid the need to relocate any homes. The applicants would make every attempt to avoid the need for relocation of residences when designing and locating the transmission line structures.

Placing a 230 kV line through a portion of the business district and residential neighborhoods could have an effect on businesses, tourism and property values but the extent of the effect is unknown. If low-profile structures are used for the 230 kV line and the design minimizes the obtrusiveness of the line, these effects should be minimal. A more detailed discussion about the effect of transmission lines on property values is in Chapter 4.

Historical and Archeological Impacts

If there would be a need for the applicants to purchase and remove any homes on South River Street, the historical significance of these homes would have to be assessed. The State Historical Society of Wisconsin (SHSW) has indicated that it is possible that standing structures which may be eligible for listing on the National Register of Historic Places could be affected by the project. The agency recommends that a qualified architectural historian survey the area of potential effect and submit a report to the SHSW.

It is not expected that the 230 kV line would be significantly taller or more obtrusive than the existing 69 kV transmission line, however, the wider diameter low-profile 230 kV line design could have an adverse visual impact on these properties.

Most of the underground construction would take place within or adjacent to city streets. Disturbance to archeological sites due to trenching activities is possible. A Phase I archeological survey would likely be required before construction begins.

Recreational Impacts

A six-year development plan for Interstate Park includes the addition of another 100-unit campground. This campground would be built adjacent to the maintenance

road south of the park entrance area. In order to avoid the physical impact of a double-circuit transmission line within Interstate Park and interference with the plans for this development, it is likely that Segment JJ_2 would be used rather than the existing 69 kV alignment which passes through the main portion of the park. Therefore, the use and enjoyment of recreational resources in this portion of the project area would not be adversely affected by this route alternative.

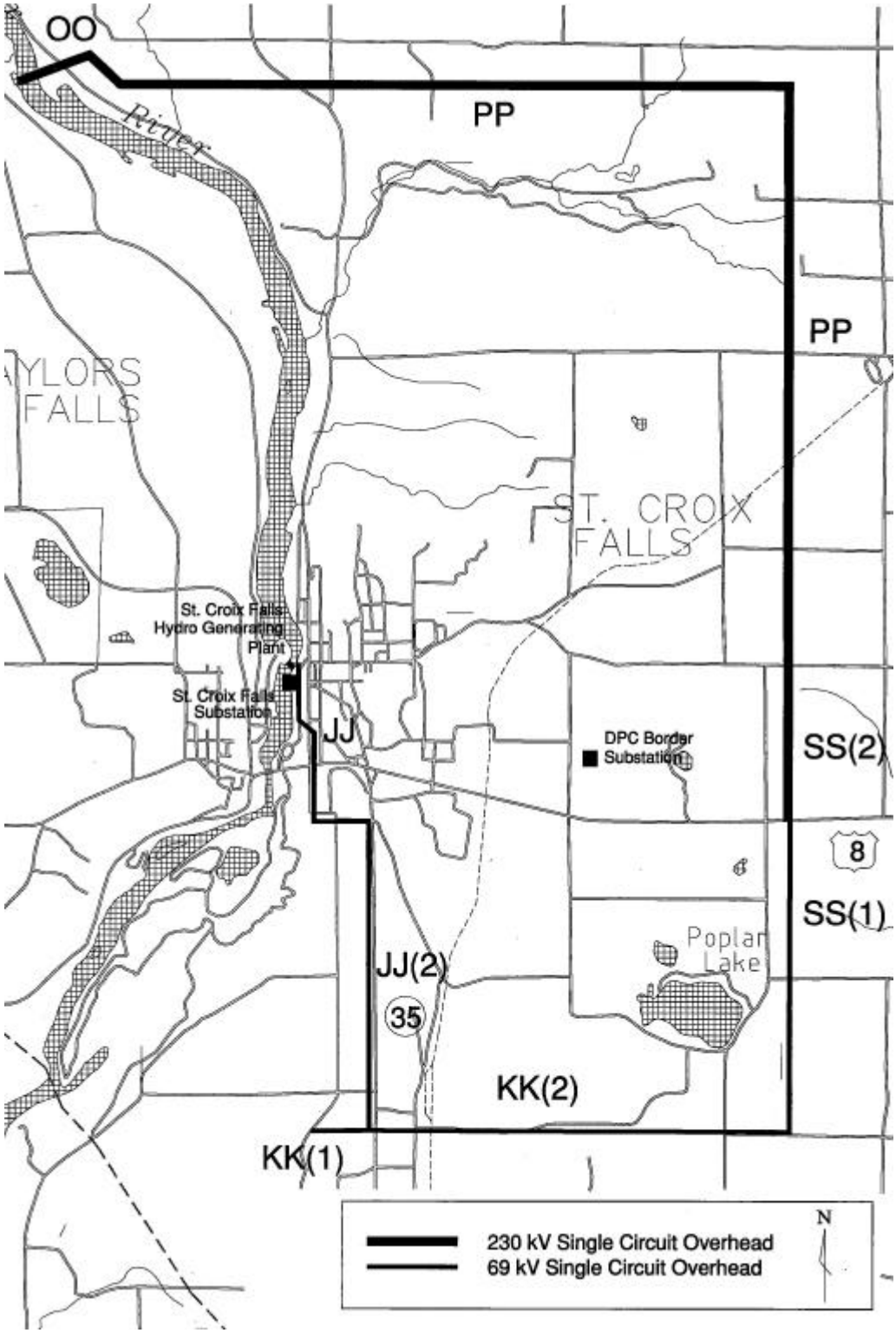
The North-Washington Route

Description

The North-Washington Route, shown in Figure 6-4, uses the northern crossing of the St. Croix River for the 230 kV line. After crossing the St. Croix River, the 230 kV line would continue due east along Segment PP for about 4.5 miles. About 0.5 mile east of 200th Avenue, the 230 kV line would turn south and continue to USH 8. The entire length of the 230 kV line route runs cross-country. The existing 69 kV line would be rebuilt along its existing ROW.

Both the 230 kV line and 69 kV line would use single-circuit overhead construction. Because of the rural nature of the landscape north of St. Croix Falls, it is likely that taller, long span steel structures would be used for the 230 kV line. The 69 kV line would be rebuilt using a narrow profile HLP design with a pole height very similar to that of the existing line.

Figure 6-4 Map of the North-Washington Route



A description of the line voltage, proposed structure type, height, and ROW width for the segments in the North Washington Route is shown in Table 6-4.

Table 6-5 The North Washington Route

Segment	Line Design							
	Length (miles)	ROW Width (feet)	Voltage (kV)	Structure Material	Structure Type	Number of Circuits	Span Length (feet)	Pole Height (feet)
OO	0.24	100	230	Steel	I-string	One	900	85-120
PP	7.52	100	230	Steel	I-string	One	900	85-120
SS_2	1.75	100	230	Steel	I-string	One	900	85-120
SS_1*	2.0	100	230/69	Steel	I-string	Two	650	100-140
JJ (city)	1.45	50-60	69	Wood	HLP	One	350	60-80
JJ_1	1.75	60	69	Wood	HLP	One	350	60-80
KK_1	0.50	60	69	Wood	HLP	One	350	60-80
KK_2	2.70	60	69	Wood	HLP	One	350	60-80

* SS1 would not be needed if the Split Route were used in the Apple River Sector. For the Split Route, the 230 kV line would extend east on USH 8 and DPC's existing 69 kV line would remain on its existing ROW.

Agricultural Impacts

The new ROW needed for the 230 kV line would cross a substantial amount of land in agricultural production. Although much of the ROW would be located along property boundaries, over 100 fields would be crossed by the proposed line. This could result in potential short-term impacts on farm operations during construction and long-term impacts following construction due to the presence of the poles. Most of the fields are used for corn, alfalfa, hay, or as pasture. Soil compaction, crop damage and interference with farm activities are possible. Because the entire route is cross-country, access for construction and maintenance could also be problematic. Some of the construction impacts could be avoided or minimized by constructing the line during a time period outside of the growing season when soils are frozen or dry.

Some minor construction impacts could also be expected along Segments JJ_1 and KK if the 69 kV line is rebuilt on the existing ROW during the growing season.

Forest Impacts

The new 230 kV line would require clearing about 35 acres of forest if this alternative is used. Most of these woodlands are on Segment PP north and east of Big Rock Creek in T34N R18W. Big Rock Creek is a designated Class I trout stream lying within a wooded valley that supports a mature forest containing primarily maple, basswood, red oak, and mixed conifers. The creek and the surrounding landscape are exceptional high quality resources due to the large size of the area and the low level of disturbance. Constructing a transmission line across or through this area would significantly affect this unique forest habitat. Impacts in forested areas include alteration of habitat, soil erosion and compaction on areas of significant slope, fragmentation and degradation

of adjacent forests where corridors are cut through large wooded blocks, and the potential for oak wilt.

Establishment or accelerated spread of oak wilt disease (as described earlier in this chapter) could result from trimming or wounding of oak trees in the spring or early summer when the beetles are active and the fungi are producing spores. If this route if used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

No new ROW clearing would be needed if the 69 kV line were rebuilt on the existing alignment. However, moving the line out of Interstate Park and placing it adjacent to Highway 35 (Segment JJ_2) would likely require an additional 20 feet of clearing in areas that are wooded.

Stream Crossings and Wetland Impacts

On Segment PP the 230 kV line would bisect the northern and western headlands of the Big Rock Creek watershed. Springs, seeps, wetlands, and permanently saturated bogs that sustain the cold water habitat of the trout stream are found in these watershed headlands[1]. Construction and maintenance activities that include drilling foundations, embedding towers and clearing ROW could adversely effect on the water quality of Big Rock Creek. Erosion and sedimentation could impact the aquatic habitat of the trout and other fish and invertebrates in the creek.

Few other wetlands or streams are present along the north route for the 230 kV line or the existing 69 kV line ROW.

Endangered/Threatened Resources

According to the Natural Heritage Inventory, other than the numerous mussel species present in the St. Croix River, no state-listed threatened or endangered species are known to be present along the proposed route. However, bald eagles, timber wolves, and Karner blue butterflies, three federally listed species, may occur in this area. A more detailed survey for these species would be recommended if this route alternative is used.

Aesthetic Impacts

The proposed 230 kV line would have a substantial visual impact on the landscape if routed along the northern corridor. The landscape is a rolling mixture of pasture, cropland and forest and scattered residential development. The view from many of the

[1] Information provided by McGhie & Betts Environmental Services, Inc. in comments on the draft EIS from Big Rock Creek Farm.

rounded hilltops is very scenic and, although the rolling terrain would hide the line to some extent, where visible, the line would detract from the aesthetic quality of the area.

The rebuilt 69 kV line would follow its existing ROW and look much the same as it does presently. After crossing USH 8 and passing through a residential area, the existing ROW crosses the park entrance area and parallels a maintenance road in a lesser-used area of the park. Removing the line from Interstate Park and placing it adjacent to Highway 35 would likely make it visible to more people but would eliminate the visual impact of the line for persons recreating in the park.

Socioeconomic Impacts

From a land use perspective, neither the 230 kV line nor the 69 kV line would be expected to hinder commercial, retail, or residential development in the area. The northern portion of the project area is primarily rural in nature and will likely remain so in the future. Because the line would follow a cross-country route rather than a well-developed corridor, the physical presence of the proposed 230 kV line could have a strong visual effect on the landscape that would adversely affect individual property owners 'use and enjoyment of their land.

The city of St. Croix Falls and Interstate Park have accommodated the presence of the existing 69 kV line to date. However, future developments in the state park could be adversely affected by the transmission line. The option of relocating the line to Highway 35 is reasonable, but must be weighed against the need to obtain additional easements along the northern boundary of the park or on McKenney Road, to clear additional ROW and the visual impact to travelers on Highway 35.

Historical and Archeological Impacts

The State Historical Society of Wisconsin (SHSW) has indicated that it is possible that standing structures which may be eligible for listing on the National Register of Historic Places could be affected by the project. The agency recommends that a qualified architectural historian survey the area of potential effect and submit a report to the SHSW.

There are many archeological sites within Interstate Park. Although the potential for adverse impacts to these sites would be small if the 69 kV line is rebuilt on its existing center line, a Phase I archeological survey would likely be required before construction begins.

Recreational Impacts

No land specifically designated as a recreational area is present along the northern route for the 230 kV line. However, ROW clearing through wooded areas and the physical presence of the line could affect landowners that engage in passive recreational activities, such as wildlife watching and hiking, on their property.

The long-term plan for another 100-unit campground in Interstate Park reduces the suitability of rebuilding the 69 kV line on its existing alignment through the park since the line would pass through or directly adjacent to the proposed campground. A relocation of this section of line from the park to Highway 35 would be a reasonable alternative.

The South-Washington Route

Description

The South-Washington Route would use the southern crossing of the St. Croix River for the 230 kV line and the existing crossing at the hydroelectric dam for the 69 kV line. The route for the 230 kV line would leave the gas pipeline ROW at CTH S and travel due east on new ROW toward Highway 35. It would intersect with an NSP 69 kV line running north from Dresser and the newly rebuilt 69 kV line running south from the hydroelectric dam. The existing 69 kV tap would be rebuilt on the new 69 kV line and a double-circuit 230/69 kV line would continue running east within the existing 69 kV transmission ROW to Segment SS_1. If this route were combined with the Split Route in the Apple River Sector, the 230 kV line would turn north on SS_1 and be double-circuited to USH 8 with DPC's 69 kV line from the Border Substation.

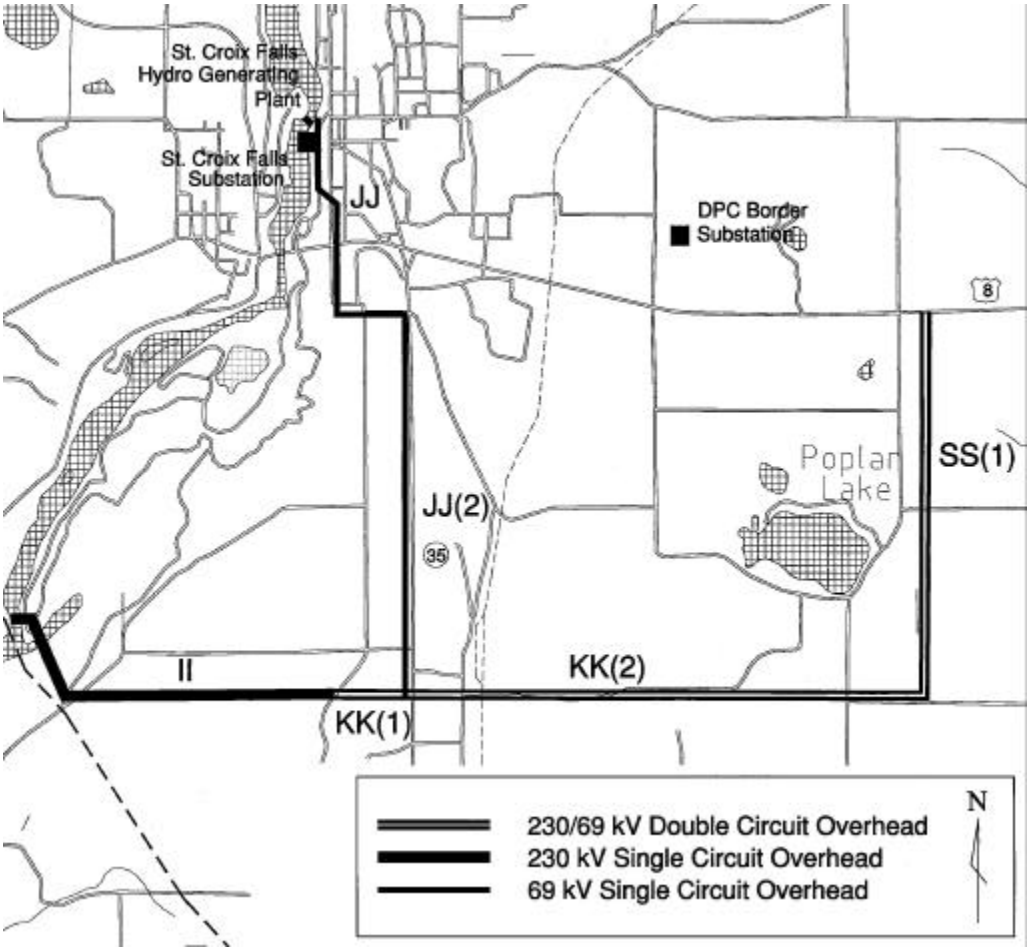
A description of the line voltage, proposed structure type, height, and ROW width for the segments in the North Washington Route is shown in Table 6-4.

Table 6-6 The South Washington Route

Segment	Line Design							
	Length (miles)	ROW Width (feet)	Voltage (kV)	Structure Material	Structure Type	Number of Circuits	Span Length (feet)	Pole Height (feet)
II	1.51	100	230	Steel	I-string	One	900	85-120
KK_1	0.20	100	230/69	Steel	I-string	Two	650	100-140
KK_2	2.70	100	230/69	Steel	I-string	Two	650	100-140
SS_1*	2.0	100	230/69	Steel	I-string	Two	650	100-140
JJ	1.45	50	69	Wood	HLP	One	350	60-80
JJ1 or JJ2	1.75	60	69	Wood	HLP	One	350	60-80

* This segment is not needed if the 230 kV line is routed within the existing 69 kV line corridor east of Segment SS. If the Split Route were used, the 230 kV line would be double-circuited with DPC's 69 kV line from the Border Substation.

Figure 6-5 Map of the South-Washington Route



Agricultural Impacts

In general, agricultural impacts would be minimal for this route alternative. The greatest potential for impact would occur at the eastern end of the St. Croix sector along Segment SS_1 where the 230 kV transmission line would run cross-country on a quarter-section line. (The 230 kV line would only need to be built on this segment if it is routed along USH 8 east of Segment SS.) Because the poles would be steel I-string structures with a span length of approximately 900 feet, expected long-term impacts on field operations should be minimal. Central pivot irrigation and aerial spraying are not commonly used in this area of the state. Adverse effects of construction on soils and crops could be avoided or minimized if construction occurs during the time outside of the growing season when soils are frozen or dry.

Forest Impacts

The additional ROW needed if both the 230 kV and 69 kV lines are built within the existing 69 kV line corridor on Segment KK will require the removal of about 40 feet of trees wherever the lines pass through wooded areas. About 20 feet of new ROW clearing would also be needed if the 69 kV line is relocated to Highway 35 (Segment JJ_2). Dominant tree species in these areas include red oak, bur oak, maple, and aspen.

Red oak, in addition to other species in the red oak family (black oak and northern pin oak), is highly susceptible to oak wilt disease. Establishment or accelerated spread of oak wilt disease (as described earlier in this chapter) could result from trimming or wounding of oak trees in the spring or early summer when the beetles are active and the fungi are producing spores. If this route alternative is used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

Stream Crossings and Wetland Impacts

After crossing the St. Croix River, this route alternative would not affect any other streams, rivers, or waterbodies. The double-circuit line could probably span a small wetland located near the intersection of Segments KK_2 and SS_1. If construction can be done with equipment confined to the roadway, impacts to the wetland vegetation and soils would be minimal.

Endangered/Threatened Species

According to the Natural Heritage Inventory, other than the species associated with the southern crossing of the St. Croix River, no state-listed threatened or endangered species are known to be present along the proposed route. Bald eagles do occur in the area and timber wolves and Karner blue butterflies may also be present. These three species are federally listed. A more detailed survey for these species would be recommended if this route alternative is used.

Aesthetic Impacts

The aesthetic impact of the 69 kV line in the city of St. Croix Falls would remain largely unchanged. Larger conductors would be used for the rebuild and the existing structures would be replaced with HLP structures that have a narrower profile. If the option to relocate the portion of the line that currently passes through the state park to Highway 35 were exercised, the line would be visible to many more people, including residents on McKenney Street and travelers on Highway 35. The aesthetic impact of this relatively small transmission line adjacent to the highway would likely be negligible to travelers on the road but could affect individual property owners, depending on its location, to a much greater degree.

The taller steel structures of a 230 kV single circuit line and a double-circuit 230/69 kV line, as well as the additional clearing for a wider ROW, could have an adverse aesthetic impact along the southern portion of this route alternative.

Socioeconomic Impacts

Use of this route alternative would not be expected to have a major impact on development or property values in the city of St. Croix Falls or the surrounding area. Within the city limits, there would be little change in the appearance of the 69 kV transmission line. If the 69 kV line were relocated to Highway 35, additional easements would be needed along the northern boundary of Interstate Park or on private property along McKenney Street.

Depending on the line design and exact location of the line, use of the southern crossing of the St. Croix River for the 230 kV line could have significant effects on the aesthetics and natural resources at that location resulting in diminished use of this area. (See South Crossing in Chapter 5.) The area that the line would pass through east of the St. Croix River is primarily rural in nature and it is not expected that the line would be a limiting factor in further development of this area. However, the new 230 kV line would be significantly taller and more visible than the existing 69 kV line and could adversely affect property owners use and enjoyment of their land or the value of property along the route.

Historical and Archeological Impacts

It is not expected that use of this route alternative would impact any known historical or archeological resources. Many archeological sites are located within Interstate Park, but they would not be affected if the 69 kV line were rebuilt within its existing ROW. Also, none of the homes on South River Street would be affected since no additional ROW would be needed for rebuilding this line. If, however, the ROWs for the new 69 kV line or the double-circuit 230/69 kV line were shifted from the existing alignments, a Phase I archeological survey would likely be required before constructions occurs.

Recreational Impacts

Segment KK crosses the Gandy Dancers Trail and passes through some privately-owned wooded property that is used for passive recreational activities by local residents. Also, hiking and ski trails in Interstate Park are located near the 69 kV line ROW and adjacent to the gas pipeline ROW at the southern end of Interstate Park. The 230 kV line could be a substantial physical and visual intrusion in these areas. The park has developed a long-term plan for another 100-unit campground adjacent to the existing 69 kV line ROW. The line could present a visual and physical intrusion in a heavily used recreational setting if this development occurs. Relocation of this section of the 69 kV line to Highway 35 would be a reasonable option.

The Apple River Sector – Existing Environment

Topography

The general topography in this portion of the project area is rolling to level. Scattered shallow depressions are present throughout the sector. Balsam Branch Creek, the Apple River Flowage, and five lakes are crossed by or adjacent to the proposed routes.

Soils

The eastern half of the project area contains scattered small areas of nearly level and gently sloping glacial lacustrine plains. Most of the soils on these plains are silty or loamy; Antigo silt loam, Rosholt loam, and Cromwell sandy loam are prominent in the uplands. Muck soils are present in many of the wet areas, particularly along USH 8 in the area of Balsam Branch Creek and Mud Lake.

Plant Communities

More large farms in this sector, compared to the St. Croix sector, limit the amount of land supporting natural vegetation; however, several larger woodlands are present in this area, including portions of the D. D. Kennedy Environmental Area and the Garfield Recreation Area. Pothole wetlands are common between the Apple River Flowage and the Apple River Substation. Some large wetlands, five lakes and several other areas containing open water are also present in this sector. Shrub/scrub vegetation and lowland hardwoods are dominant in most of these areas.

Land Use

Agriculture is a more dominant land use in the Apple River sector than the St. Croix sector. Dairy farming is the primary agricultural activity. Crops grown include hay, corn, and alfalfa. There is less commercial development along this section of USH 8 than near St. Croix Falls. Residential development is scattered throughout the area. The communities of Balsam Lake and Amery are outside of the project area boundary. Several county-owned properties provide opportunities for recreational and outdoor educational activities.

The Apple River Sector – Route Alternatives

There are three route alternatives, the Double South Route, the South-USH 8 Route, and the Split Route in the Apple River sector. The Apple River Substation is a large substation that supports the interconnection of numerous transmission lines. Detailed

maps of the Apple River Substation area are shown for each route in addition to the route map.

Any of the previously described route options for the St. Croix sector could be combined with the three route alternatives in this sector. Table 6-7 summarizes some information about the alternatives.

Table 6-7 The Apple River Sector Route Alternatives

	Double South Route	South-USH 8 Route	Split Route
Total Length	14.6 miles	20.2 miles	28.4 miles
ROW New (80-100') Widen (20-50') No change	 0. 6 miles 14.0 miles 0 miles	 0 miles 18.7 miles 2.5 miles	 0.5 miles 21.9 miles 6.0 miles
Percent corridor-sharing	96%	100%	98%
Type of corridor-sharing (miles)	0.25 Road 13.75 T-line	1.7 Road 19.5 T-line	10.9 Road 17.0 T-line
Homes within 100 ft.	4	13	29
Homes within 300 ft.	13	34	88
Comm./indus. Within 300 ft.	0	0	28
Public facilities within 300 ft.	2 parks 1 bible camp	1 park	1 school 2 parks 1 bible camp
Estimated Cost	$8,965,000*	$10,284,900*	$9,380,0000
Primary Impacts	Additional ROW requirements and incremental adverse aesthetic impacts in the D. D. Kennedy Area, Garfield Recreation Area (Polk County). New crossing of the Apple River Flowage. Crosses 2 major streams and runs by 3 lakes.	Potential adverse aesthetic impacts on USH 8 and the need for tree removal in wooded wetlands along the highway. Crosses 2 major streams and runs by 3 lakes.	Adverse incremental effect of two separate transmission line corridors. Need for tree removal in wooded wetlands adjacent to USH 8. New crossing of the Apple River Flowage. Four major stream crossings and runs by 5 lakes.

[1] If combined with Dam-Double Washington or South-Washington this number is reduced by $1,180,000.

The Double South Route

Description

The Double South Route, shown in Figures 6-6 and 6-7, would involve building a double-circuit 230/69 kV line within the existing 69 kV line ROW from Segment SS_1 (near 208th St) east to the Apple River Substation. The existing alignment would be modified where it crosses the Apple River Flowage. The new crossing of the flowage would be located approximately 0.25 mile north of the existing crossing. The new crossing would pass through a pine plantation north of the homes and cottages on Birchwood Lane near Amery. After crossing the flowage, the double-circuit line would turn south paralleling STH 46 for about 0.25 mile before rejoining the existing 69 kV ROW (Segment MM) and continuing east to the Apple River Substation.

A description of the line voltage, proposed structure type, height, and ROW width for the segments in the Double South Route is shown in Table 6-8.

Table 6-8 The Double South Route

Segment	Line Design							
	Length (miles)	ROW Width (feet)	Voltage	Structure Material	Structure Type	Number of Circuits	Span Length (feet)	Pole Height (feet)
LL	6.0	100	230/69 kV	Steel	I-string	Two	650	100-140
MM	7.76	100	230/69 kV	Steel	I-string	Two	650	100-140
XX	0.70	100	230/69 kV	Steel	I-string	Two	650	100-140

Figure 6-6 Map of the Double-South

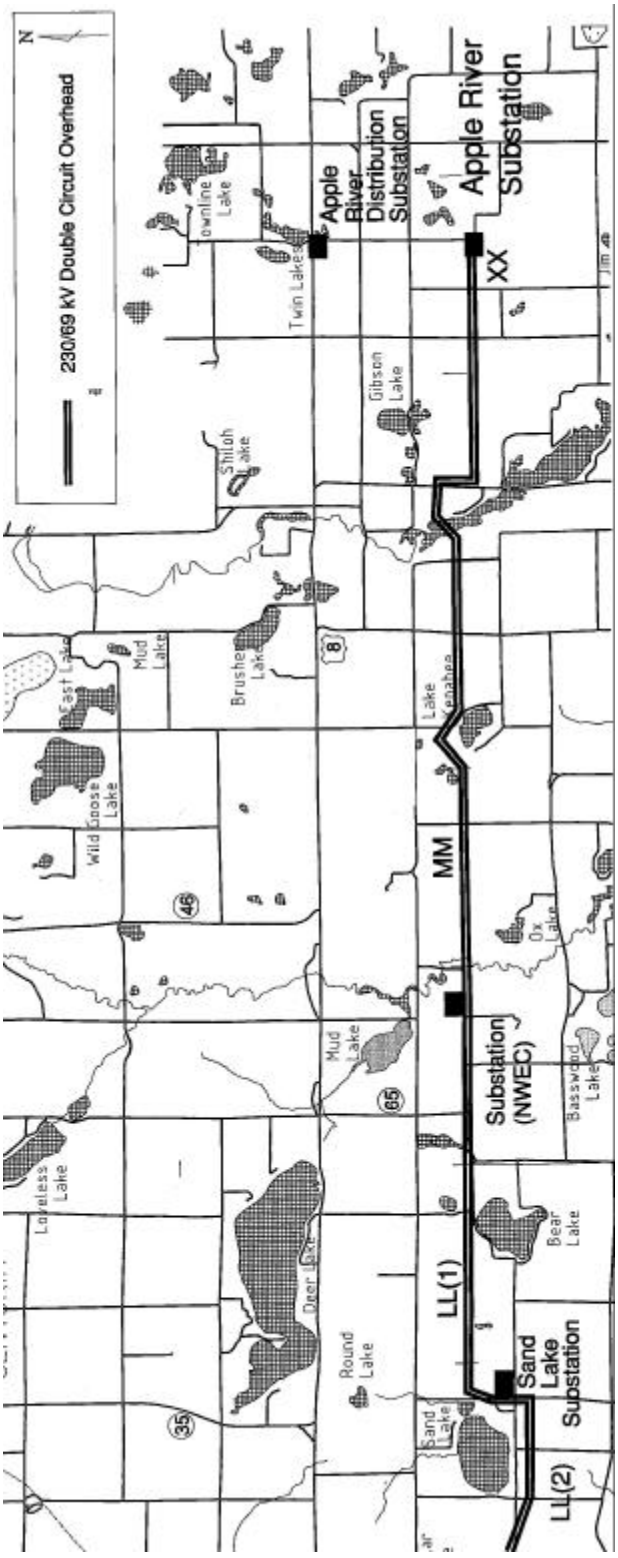
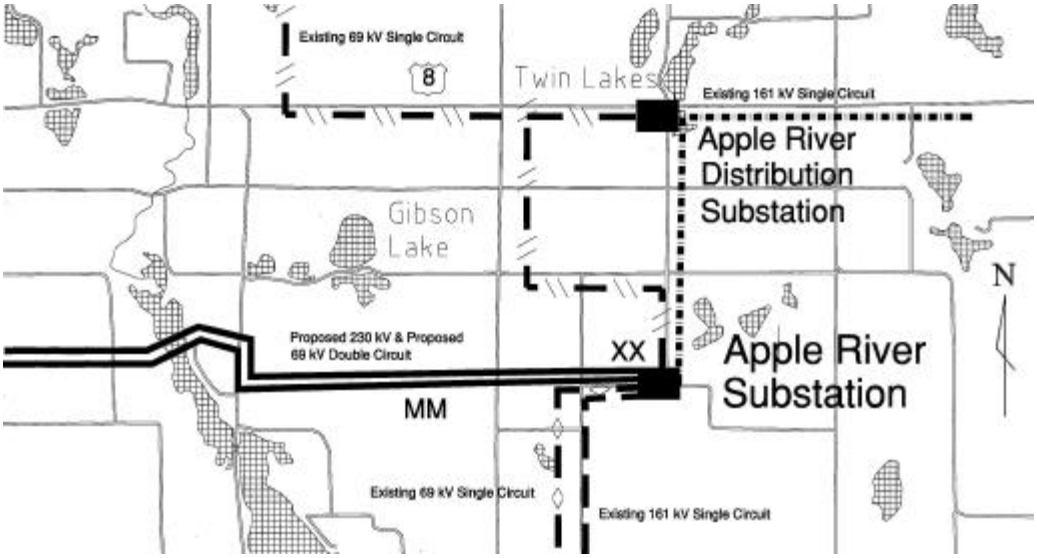


Figure 6-7 Map of the Double South Route at the Apple River Substation



Agricultural Impacts

The Double South Route passes through a significant amount of farmland between the Sand Lake Substation and the Apple River Substation. Some of these fields are adjacent to a road and poles would be placed just outside of the road ROW along field edges. In many locations, however, the line runs cross-country through agricultural land, resulting in poles in the middle of fields. The new steel poles would be larger than the existing wood poles and may require a concrete foundation. Span lengths between the new structures, however, would be longer resulting in fewer poles located within fields.

Short-term impacts, such as crop damage or soil compaction are possible if construction occurs during the growing season. Impacts on farming operations, such as maneuvering around poles with farm equipment, would not likely increase. Central pivot irrigation and aerial spraying of crops are not common agricultural practices in this part of the state.

Forest Impacts

The additional 40 feet of additional ROW needed for a double-circuit 230/69 kV line would require the removal of about 55 acres of trees. Most of this forest area occurs in two locations, directly west of Balsam Branch Creek and west of the Apple River Flowage. Dominant tree species in these areas include lowland hardwoods, such as green ash and American elm, and mixed upland hardwoods including bur oak, red oak,

and basswood. A short section of new ROW (100-feet-wide) would need to be cleared through a pine plantation if the Apple River flowage crossing is relocated.

These forested lands primarily provide wildlife habitat and recreational opportunities. Some timber production occurs on privately owned lands. Loss of trees would adversely affect these forest uses. Degradation of adjacent woodlands could also be adversely affected through the encroachment of weedy species from the ROW.

Red oak, in addition to other species in the red oak family (black oak and northern pin oak), is highly susceptible to oak wilt disease. Establishment or accelerated spread of oak wilt disease (as described earlier in this chapter) could result from trimming or wounding of oak trees in the spring or early summer when the beetles are active and the fungi are producing spores. If this route alternative is used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

Wetlands, Lakes, and Stream Crossings

The two major waterways crossed by this route are Balsam Branch Creek and the Apple River Flowage. Balsam Branch Creek is fairly narrow and could be spanned easily by the double-circuit line. The Apple River flowage would also be spanned, but may require special structures for this purpose. If poles were placed away from stream banks, no adverse impacts on water quality would be expected.

Although the line does not cross any lakes, it passes nearby three lakes and several smaller areas of open water. No direct impacts to these resources are expected, but the line would likely be visible to persons using or residing on these lakes.

Numerous waterfowl are present along the Apple River flowage and several of the local lakes during migration periods. Trumpeter swans, a state endangered bird, have also been observed on the Apple River flowage in recent years. The potential for bird-wire collisions would exist during times of low light or fog conditions. If this route is used, attachment of aerial markers on the conductors over the flowage and along the shoreline of area lakes should be considered.

Endangered/Threatened Species

According to the Natural Heritage Inventory, no state-listed threatened or endangered species, other than the trumpeter swans discussed above, are known to be present along the proposed route. Bald eagles occur in the project area and timber wolves and Karner blue butterflies may also be present. These three species are federally listed. A more detailed survey for these species would be recommended if this route alternative is used.

Aesthetic Impacts

Replacement of the existing 69 kV wood poles with taller double-circuit steel structures supporting larger conductors would increase the visibility of the line. Also, the wider ROW needed would require trimming and removal of additional trees resulting in visual landscape changes.

This incremental change in the scale of the line and ROW could adversely affect the use and enjoyment of property along the route by residents in this rural setting and persons recreating in the general area (see recreational impacts).

Socioeconomic Impacts

Because this route uses an existing transmission line corridor for its entire length, major impacts on residential, commercial, or retail development of property would not be expected as a result of this project. It is possible, however, that the larger size and higher voltage of the new double-circuit line would affect landowners use and enjoyment of their property and the value of some properties. Some scattered residential development has occurred near the existing 69 kV line ROW east of 208th Street in recent years and this type of development would likely continue.

Historical and Archeological Impacts

Because of the number of inland lakes, streams and creeks located within this portion of the project area, this route has a high potential for archeological sites. The sites could range over a wide period of history including campsites dating from prehistoric times to structures associated with recent European habitation. Construction entirely within the existing ROW would reduce the possibility of impacts on these resources. However, because of the need for new transmission poles and changes in span length, a Phase I archeological survey would likely be required prior to the beginning of construction.

Recreational Impacts

This route passes through the Garfield Recreation Area and adjacent to the D.D. Kennedy Environmental Area. These properties have been set aside by Polk County to provide opportunities for recreational and educational outdoor activities. The proposed line would pass directly over walking paths, cross-country ski trails and a snowmobile trail. The increased size of the line and the need for additional tree trimming and removal could adversely affect the aesthetic experience of trail users. The double-circuit line would also cross the Wapogasset Lutheran Bible Camp (Ox Lake Camp) used as a summer youth camp. Hiking and ski trails are also present on this land. The Balsam Branch State Wildlife area is located less than one mile south of the Double South Route and the D.D. Kennedy Environmental Area. Together, these public and private properties comprise a very large area of high-quality habitat for aquatic and terrestrial plants and animals that is accessible to the public.

Further to the east, the double-circuit line would span the Apple River flowage. Because of mandatory height requirements for transmission lines over navigable waterways, use of any type of boat on this water body should not be affected.

The South-USH 8 Route

Description

The South-USH 8 Route involves double-circuiting the 230 kV and 69 kV lines on the existing 69 kV line ROW for about five miles and then running the double-circuit line north on Segment VV to USH 8. The 230/69 kV line would continue east on USH 8, across the Apple River, to the intersection of STH 46 South. At this intersection, the lines would separate; the 69 kV line would turn south on STH 46 to rejoin the existing 69 kV line ROW (Segment MM), and the 230 kV line would continue east and south to Segment XX. On USH 8, near Shiloh Lake, an existing DPC 69 kV line (from the north) would join the 230 kV line and the two lines would be double-circuited for a portion of Segment WW.

A description of the line voltage, proposed structure type, height, and ROW width for the segments in the South-USH 8 Route is shown in Table 6-9.

Table 6-9 The South-USH 8 Route

Segment	Line Design							
	Length (miles)	ROW Width (feet)	Voltage (kV)	Structure Material	Structure Type	Number of Circuits	Span Length (feet)	Pole Height (feet)
LL	6.0	100	230/69	Steel	I-string	Two	650	100-140
VV	1.47	100	230/69	Steel	I-string	Two	650	100-140
UU	5.70	100	230/69	Steel	I-string	Two	650	100-140
WW	3.03	100	230/69	Steel	I-string	Two	650	100-140
XX	0.70	100 80	230 69/69	Steel Wood	I-string Davit	One Two	900 400	85-120 80-100
104	1.70	50	69	Wood	HLP	One	400	60-80
MM	2.45	60	69	Wood	HLP	One	400	60-80

Figure 6-8 Map of the South-USH 8 Route

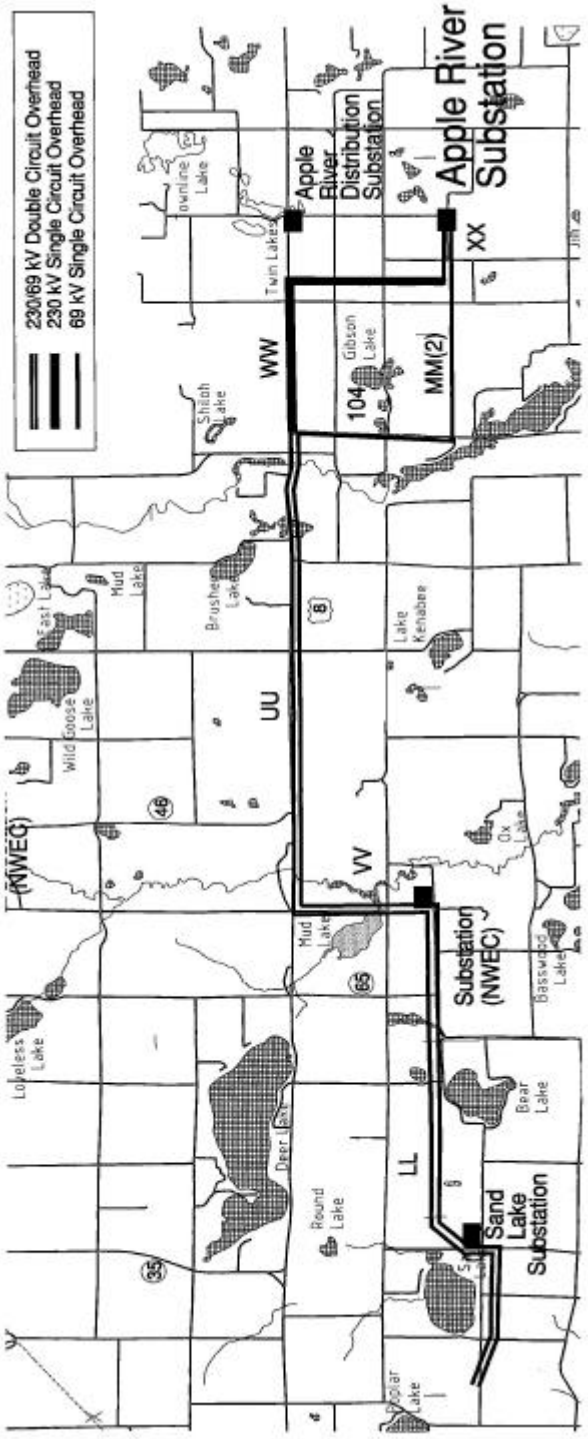
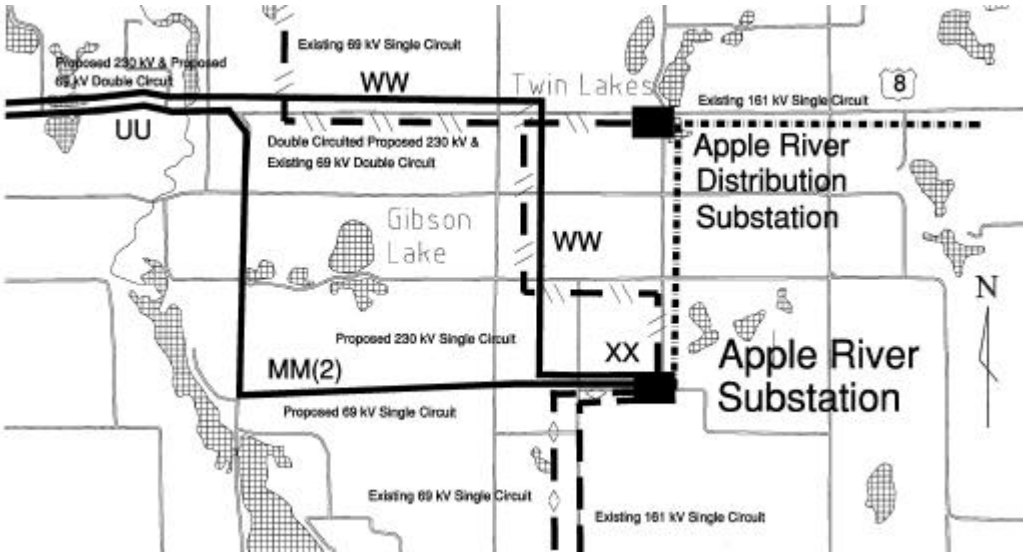


Figure 6-9 The South-USH 8 Route at the Apple River Substation



Agricultural Impacts

This alternative would affect agricultural land between Sand Lake and Balsam Branch Creek, some fields adjacent to USH 8 near the Apple River Cemetery, and the fields surrounding the Apple River Substation. Primary agricultural crops are hay, corn, and alfalfa. Some pastureland is also present. The existing proposed route runs cross-country and passes through many fields between Sand Lake and Bear Lake and near the eastern end of the project north of the Apple River Substation. Construction of the new line could cause short-term impacts such as soil compaction and crop damage in these areas. The larger double-circuit structures would allow longer span lengths and it is possible that the number of poles located in fields would decrease.

In other areas along this route, the agricultural fields are located along town roads and highways. Poles would be placed along field edges outside of the road ROW and should have minimal impact on field operations. If access and movement of construction equipment can be confined to the roadway in these areas, short-term construction impacts could also be minimized.

North of the Apple River Substation, near Main Crossings Road, an existing 69 kV line passes over a ginseng garden. The new double-circuit line would easily span the structures shading the garden and because planting, maintenance, and harvesting of this cash crop is done by hand, the line would not impact these operations.

Forest Impacts

In total, this route alternative would affect about 40 to 45 acres of forested land; approximately 35 acres of this acreage would be new ROW. In upland areas the dominant tree species affected would be northern red oak, bur oak, aspen, basswood, and sugar maple.

Red oak, in addition to other species in the red oak family (black oak and northern pin oak), is highly susceptible to oak wilt disease. Establishment or accelerated spread of oak wilt disease (as described earlier in this chapter) could result from trimming or wounding of oak trees in the spring or early summer when the beetles are active and the fungi are producing spores. If this route alternative is used, construction and maintenance activities should follow the standards described in the Wisconsin Department of Natural Resources' "Statewide Utility Guidelines for Cutting and Pruning Oak."

Along USH 8 and 150th Street (Segment VV), where new ROW would be needed, the dominant forest type affected would be swamp conifers and lowland hardwoods. Clearing trees and construction of the new line in these areas could adversely impact wetland soils, water quality, wildlife habitat and the quality of the remaining forested wetland. There is a potential for soil erosion and compaction, disturbance and destruction of adjacent wetland vegetation, and encroachment or establishment of weedy plant species, such as purple loosestrife or reed canary grass.

Purple loosestrife, an invasive, non-native weed, may be introduced to a wetland or spread by seeds or plant parts carried on construction equipment that has been used in an infested area. Once introduced to a wetland, purple loosestrife spreads rapidly, crowding out native vegetation. Purple loosestrife has little value for wildlife in providing food or cover.

Wetlands, Lakes and Stream Crossings

Most of the wetlands affected by use of this route alternative are located along USH 8, 150th Street and north of the Sand Lake Substation. These wetlands consist primarily of shrub/scrub mixed with emergent vegetation. No clearing of this low-growing shrubby vegetation would be needed. Potential impacts would include many of those described above for forested wetlands, including soil compaction leading to changes in wetland hydrology, vegetation disturbance and the encroachment or establishment of non-native weedy species.

The route crosses Balsam Branch Creek and the Apple River. In addition, it passes by several lakes, including Sand Lake, Bear Lake, and Mud Lake. Numerous waterfowl are present in several of the local lakes during migration periods. The potential for bird-wire collisions would exist during times of low light or fog conditions. If this route is used, attachment of aerial markers on the conductors that pass along the shoreline of area lakes should be considered.

Endangered/Threatened Resources

According to the Natural Heritage Inventory, no state-listed threatened or endangered species are known to be present along the proposed route. Bald eagles occur in the project area and timber wolves and Karner blue butterflies may also be present. These three species are federally listed. A more detailed survey for these species would be recommended if this route alternative is used.

Aesthetic Impacts

This route alternative uses a combination of existing ROW (Segment LL and VV) and new ROW (Segment UU). Along the existing 69 kV line ROW, the larger taller structures would represent an incremental visual impact to residents and property owners. The double-circuit line would also require an additional 40 feet of ROW that may adversely affect small woodlots or landscape trees.

Along USH 8, east of 150th Street, the 230/69 kV line would be visible to a large number of people, including those traveling on the road and residents in the area. It is likely that the line would also be visible to persons fishing and boating on several of the lakes that are adjacent to the route. Several homes are located along USH 8 in close proximity to the road. The ROW requirements for the line could result in the trimming of landscape trees on these properties.

At the present, a DPC 161/69 kV double-circuit line runs east from the Apple River Substation to Barron. The new line for the Chisago Electric Transmission Line Project would be similar in height and width and could be viewed as an extension of the existing DPC circuits. (However, between Apple River and Barron the distribution circuits are located within the same ROW as the 161/69 kV transmission line but on separate wooden poles. The distribution lines on USH 8 west of Apple River would be buried if this route were used, resulting in only one type of utility pole.)

Socioeconomic Impacts

Because of the existing land uses along this route, major impacts on residential, commercial, or retail development of property would not be expected as a result of this project. Along the existing 69 kV transmission line corridor and on USH 8, some property owners may find that the large structures and wider ROW of the double-circuit 230/69 kV line detract from their use and enjoyment of their land. Several homes are in close proximity to the road along USH 8 and it is possible that landscape trees on their property would need to be trimmed in order to accommodate the double-circuit line. Affects on property values are possible (refer to Chapter 4).

Existing quarry operations on the north and south side of Mains Crossing Road could be affected by the presence of a large high-voltage line. An existing 69 kV line presently passes directly through the quarry.

Historical and Archeological Impacts

Because of the number of inland lakes, streams and creeks located within this portion of the project area, this route has a high potential for archeological sites. The sites could range over a wide period of history including campsites dating from prehistoric times to structures associated with recent European habitation. Because of the need for new structures, a Phase I archeological survey would likely be required prior to the beginning of construction. If the line were routed along the south side of USH 8, effects on the Apple River Cemetery could be avoided.

The privately owned Deer Lake School on USH 8, built in 1930, has been designated as an historical site by the Polk County Historical Society. The line could be a physical and visual intrusion on the setting and character of this property.

Recreational Impacts

This route alternative does not pass through any designated recreation areas. It avoids the Garfield Recreation Area but passes adjacent to the D. D. Kennedy Environmental Area. It also passes near several local lakes, including Sand Lake and Bear Lake that are frequented by boaters and fishers. Although the construction or presence of the line would not directly affect the lakes, the line would be visible from these lakes and could detract from the users 'enjoyment.

The Split Route

Description

The Split Route involves using two separate routes for the 69 kV and 230 kV lines. A new single-circuit overhead 230 kV line would be built adjacent to USH 8 for about 11 miles before turning south to proceed to the Apple River Substation. The 69 kV line would be rebuilt on new structures within its existing ROW. This route alternative would require new transmission line ROW and create new impacts adjacent to USH 8 for the 230 kV line and would maintain the existing appearance and impact associated with the 69 kV line on the southern ROW. The only proposed modification of the 69 kV alignment would occur at the Apple River crossing. The crossing would be relocated about ¼ mile to the north to avoid passing over homes and cottages on the shoreline of the flowage. About 50 feet of new ROW would be needed adjacent to USH 8 for the 230 kV line. The remainder of the 100-foot-wide ROW could overlap with the road corridor.

A description of the line voltage, proposed structure type, height, and ROW width for the segments in the Split Route is shown in Table 6-10.

Table 6-10 The Split Route

Segment	Line Design							
	Length (miles)	ROW Width (feet)	Voltage (kV)	Structure Material	Structure Type	Number of Circuits	Span Length (feet)	Pole Height (feet)
103	5.20	100	230	Steel	I-string	One	900	85-120
UU	5.70	100	230	Steel	I-string	One	900	85-120
WW	3.03	100	230/69	Steel	I-string	Two	650	100-140
LL	6.0	60	69	Wood	HLP	One	450	60-80
MM	7.76	60	69	Wood	HLP	One	450	60-80
XX	0.70	100 80	230 69/69	Steel Wood	I-string Davit	One Two	900 450	85-120 80-100

Figure 6-10 Map of The Split Route

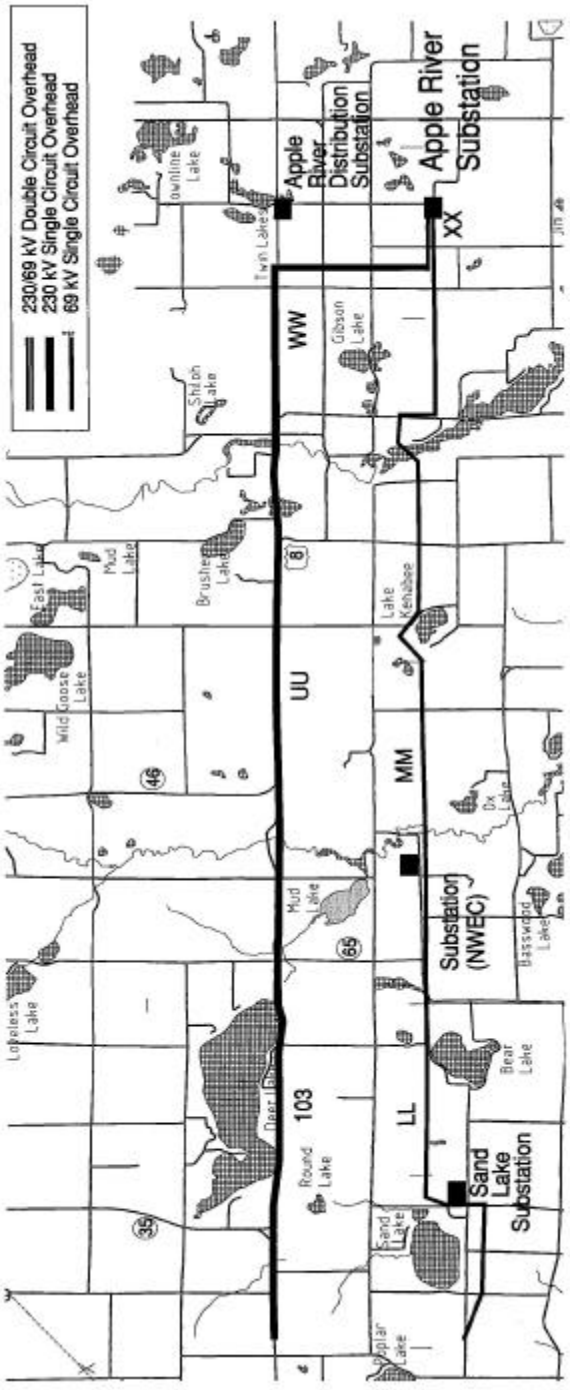
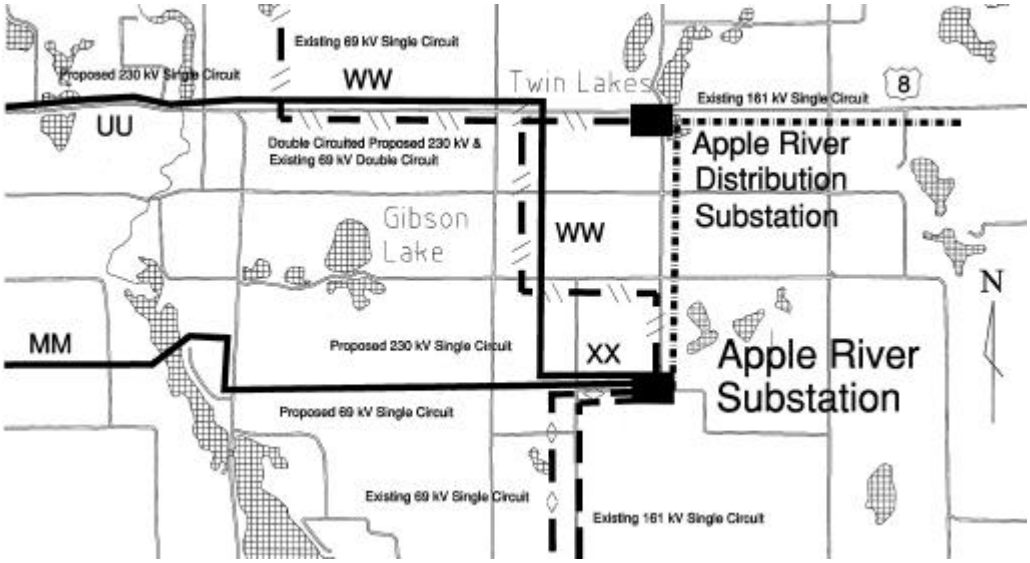


Figure 6-11 The Split Route at the Apple River Substation



Agricultural Impacts

The agricultural areas affected by this alternative include the area north of the Apple River Substation, a section west of CTH H near the Apple River cemetery, lands directly south and west of Deer Lake, and much of the area between Sand Lake and Balsam Branch Creek. The majority of this land is producing hay or corn; none of it is irrigated. Some pastureland is also present. Aerial spraying of crops is not a common practice in this area.

Many of the fields are adjacent to roads or highways. At these locations, structures for a new power line would most likely be placed at the edge of fields several feet outside of the road ROW. The potential for soil compaction and crop would be minimal, especially if construction equipment could access new pole locations from the highway or road ROW. Little or no additional impact on farm operations would be expected. In places where poles would be installed in the middle of fields, construction could be confined to the period of time outside of the growing seasons when soils are frozen or dry to avoid causing crop damage or soil compaction.

North of the Apple River Substation, near Main Crossings Road, the existing 69 kV line passes over a ginseng garden. A new double-circuit 230/69 kV line would easily span the structures shading the garden and because planting, maintenance, and harvesting of this cash crop are done by hand, the line would not impact these operations.

Forest Impacts

A variety of woodland types would be affected by the use of this route alternative. Little additional clearing would be required along the existing 69 kV line ROW if the 69 kV line is rebuilt on the existing centerline. A short section of new ROW (60-feet-wide) would need to be cleared through a pine plantation if the crossing of the Apple River flowage is relocated to the north approximately 0.25 mile.

Placement of the 230 kV line adjacent to USH 8 would result in approximately 24 acres of woodland clearing. In uplands, northern mesic species such as aspen, basswood, red oak and bur oak would be removed. Clearing along the edge of several wooded wetlands consisting of conifer swamp and lowland hardwoods would also be needed.

Potential impacts in forested areas include loss of woodland habitat, soil compaction (especially in wet forested areas), and degradation of woodland quality due to increased exposure to sunlight, runoff, and encroachment of weedy roadside vegetation. Construction in wooded wetlands could adversely affect the water quality of adjacent streams and lakes if erosion and sedimentation are not adequately controlled.

Wetlands, Lakes, and Stream Crossings

This route alternative would cross several streams and rivers in addition to a few areas of open water. The 230 kV line would span Toby Creek, which drains into Mud Lake and both lines (on separate ROWs) would cross Balsam Branch Creek. Removal of wooded wetlands adjacent to these creeks could adversely affect the water quality through increased water temperatures due to loss of shade and increased water turbidity caused by soil erosion. Changes in water quality could reduce the diversity of aquatic life.

Further east, both lines would cross the Apple River. South of USH 8, the river widens significantly. A new crossing location, about 0.25 mile north of the existing crossing would be used. Spanning of the flowage for the 69 kV line would likely require use of H-frame or another type of long-spanning structures. To avoid adverse impacts on the flowage the new structures should be placed well back from the water and significant removal of wooded vegetation on the riverbanks should be avoided.

Several areas of open water lie adjacent to USH 8 about 0.5 mile west of the Apple River. These areas are relatively large and could require the placement of poles in or at the water's edge. These waterbodies are part of a large complex of lakes, rivers, streams, woods, and wetlands that dominate the landscape of eastern Polk County. The potential for use of these open water areas by migrating waterfowl, geese, swans, and other water birds is high.

In total, the 230 kV line and 69 kV line would pass by or near five lakes: Deer Lake, Mud Lake, Bear Lake, Sand Lake, and Lake Kenabee. Some of these lakes are heavily used by waterfowl and the potential for bird-wire collisions would exist during times of

low light or fog conditions. If this route is used, attachment of aerial markers on the conductors that pass along the shoreline of area lakes should be considered.

Aesthetic Impacts

A 230 kV line placed on tall steel structures adjacent to USH 8 would be very visible to persons traveling on USH 8 as well as permanent residents and property owners in the area. Similarly sized oxidized steel structures supporting a double-circuit 161/69 kV line are located along USH 8 between the Apple River Substation and Barron.

Scattered areas of commercial development are already present along the section of USH 8 stretching east from the crest of the river valley toward Barron, but the presence of the 230 kV structures would result in an additional aesthetic impact. When constructed, the new line would appear to be an extension of the existing DPC 161/69 kV line between the Apple River Substation and Barron. DPC and Polk-Burnett Cooperative, the entities that provide electric service in the area, propose to bury the distribution circuits that are present on USH 8 rather than attach them to the new line or allow them to remain on separate structures (as they are on the Apple River – Barron line).

Several homes are located along USH 8 in close proximity to the road. In addition, there is a significant amount of residential development along the shore of Deer Lake. The ROW requirements for the line could result in the trimming of landscape trees on some properties. Use of slight modifications in the ROW alignment could reduce the visual impact of the line on these properties.

There would be little change in the appearance of the 69 kV line. Removing the line from its present location through the residential setting on the east shore of the Apple River flowage would be an aesthetic improvement for those property owners.

Socioeconomic Impacts

From a land use perspective, it is not expected that a new single circuit 230 kV line would have a major effect on further development along USH 8. Because of the noise and traffic volume associated with the highway (which would be expected to increase in the future), residential or commercial development adjacent to the highway should not be greatly affected by the line. The visual impact of the 230 kV line could adversely affect land values of existing property owners, especially if existing vegetation or landscape features need to be removed or substantially altered to accommodate the line.

Because the appearance of the 69 kV line and its existing ROW would remain unchanged when it is rebuilt, no adverse socioeconomic impacts would be expected to occur in that portion of the project area.

Historical and Archeological Impacts

Because of the large number of inland lakes, rivers, and creeks in this vicinity, the archeological sites of varying origins are likely scattered throughout this portion of the project area. The sites include campsites dating from prehistoric times and structures associated with recent European habitation. A Phase I archeological survey of the selected route is strongly recommended if this project is approved. Impacts on the Apple River Cemetery could be avoided if the 230 kV line is routed along the south side of USH 8.

The privately owned Deer Lake School on USH 8, built in 1930, has been designated as an historical site by the Polk County Historical Society. The line could be a physical and visual intrusion on the setting and character of this property.

Recreational Impacts

The 230 kV line does not pass through any designated recreation areas. The 69 V line, if built on the existing alignment, passes through the Garfield Recreation Area and the Wapogasset Lutheran Bible Camp (Ox Lake Camp). It also runs adjacent to the D. D. Kennedy Environmental Area. These areas support a variety of uses, such as hiking, cross-country skiing and outdoor education. Because the size and appearance of the 69 kV rebuild would remain the same as the existing line, no new recreational impacts would be expected.

Changes to Apple River Substation

The proposed project includes several changes to the existing Apple River Substation. No new property would be required but the size of the fenced area would need to be increased. This would necessitate some grading and clearing of trees and brush.

To accommodate the new 230 kV line the following 230 kV equipment will be added:

- A tubular-steel termination structure.
- Two 2,000 amp, 40 kilo amperes gas circuit breakers.
- Two 1,200 amp disconnect switches.
- Three coupling capacitor voltage transformers (CCVT).
- Three surge arrestors.
- One 1,200 A, air-core line trap on the terminal line.
- Two 230 to 161 kV transformers.

On the low side of the transformers:

- Two 161 kV motor-operated disconnect switches.
- Two 161 kV single phase CCVTs.

The existing two lattice-type line termination structures for the Crystal Cave and Barron 161 kV lines would be replaced with a tubular steel structure. Five additional circuit breakers and ten motorized disconnect switches, CCVTs, and other associated equipment would be upgraded to 2000 amp rating.

Appendix
A

Appendix A - Chronology of Planning and Determining Transmission Improvements for Northwestern Wisconsin

Overview

For the past 15 years or so, the transmission system in northwestern Wisconsin has been and continues to be studied to determine appropriate transmission improvements. It is a complex area because it is the boundary between two reliability councils, MAPP and MAIN. It involves two western Wisconsin utilities (DPC and NSP) and several eastern Wisconsin utilities: Madison Gas and Electric Company (MGE), Wisconsin Electric Power Company (WEPCO), Wisconsin Power and Light Company (WP&L), Wisconsin Public Power Incorporation SYSTEM (WPPI), and Wisconsin Public Service Corporation (WPS). The lines in the area are critical for reliability and economic reasons.

Construction is in progress for several projects that resulted from these studies. One is the new Rock Creek-Grantsburg 69 kV line to improve reliability for customers served by Northwestern Wisconsin Electric Company (NWEC). Another is the reconductor/rebuild of the Baldwin-Marathon City 161 kV line to replace an existing NSP and WPS line. Lastly and most recently is the new Stone Lake-Bay Front 161/69 kV along the ROW of an existing 69 kV line to improve reliability for customers served by NSP and cooperatives served by DPC.

The need for further transmission additions to improve reliability persists beyond these projects because customer loads have increased beyond past forecasts. Previously, the dominant reason to make improvements in this area had been solely to increase west-to-east transfer capability for economic reasons, but this factor is secondary to reliability now. At the present time, the Commission is conducting a study as required by 1997 Wisconsin Act 204 to identify and relieve any constraint on an intrastate or interstate transmission system that adversely affects the reliability of transmission service to electric customers in Wisconsin. This study includes problems and solutions in northwestern Wisconsin.

1984-1985

NSP and WPS determined that most of the 1930 vintage King-Sherman Street 115 kV line (between the King Power Plant near Bayport, MN and the Sherman Street Substation in Wausau, WI) is in poor condition. This line and the King-Eau Claire-Arpin-Rocky Run 345 kV line are the main high-voltage lines connecting Western Wisconsin Utilities (WWU) to Eastern Wisconsin Utilities (EWU). Analysis was begun for options to replace the 115 kV line in kind or with one of higher voltage (161 kV or 345 kV).

August 1986

The Commission issued its Advance Plan 4 order. The order required utilities to initiate a joint planning study on a single-system basis for the interface area between the EWU and the WWU, as described in Appendix O of the order. According to Appendix O, the study was to investigate the problems caused by the outage of the Eau Claire-Arpin-Rocky Run 345 kV line and alternatives to solve those problems, given the existing levels of power transfer at that time. The solutions considered included new interconnections of existing lines, reconductoring or upgrading existing lines, and construction new 115 kV, 138 kV, or 161 kV lines between eastern and western Wisconsin.

July 1988

The EWU/WWU Interface Study was completed. Participants included DPC, MGE, NSP, WEPCO, WP&L, WPPI, WPS, and Commission staff. The Interface Study identified transmission alternatives to improve transfer capability between western Wisconsin and eastern Wisconsin and reviewed them for costs, compatibility with local area solutions, environmental aspects, and flexibility. The Interface Study did not address the non-technical or institutional issues that might affect use of the transmission system.

The plans that resulted from the study consisted of two parts, one west of Eau Claire (plans WEST B through WEST H) and one east of Eau Claire (plans EAST B through EAST H), except one that consisted of a new 345 kV line across Wisconsin (plan WEST/EAST A). The study assumed that any WEST plan and any EAST plan could be combined to produce at least 1,000 MW of first contingency incremental transfer capability between MAPP and EWU. The main components of the plans are:

Table A--1 1988 EWU/WWU Interface Study Plans

WEST/EAST A	Add a King-Wissota-T Corners-Weston-Wesbay (Green Bay) 345 kV line Loop the Kewaunee-North Appleton 345 kV line into Wesbay Add a Wissota-Eau Claire 161 kV line
WEST B	Reconductor Pine Lake-Wissota 115 kV line with 795 SSAC
WEST C	Add King-Wissota 345 kV line Add Wissota-Eau Claire 161 kV line
WEST D	Convert the King-Wissota 115 kV line to 161 kV Convert the Red Rock-Crystal Cave 115 kV line to 161 kV
WEST E	Add Chisago-Apple River 161 kV line Reconductor Pine Lake-Wissota 115 kV line with 795 SSAC
WEST F	Add Chisago-Apple River 161 kV line Convert the King-Wissota 115 kV line to 161 kV Convert the Red Rock-Crystal Cave 115 kV line to 161 kV
WEST G	Add a Prairie Island-Red Wing-Rock Elm-Red Cedar 161 kV line
WEST H	Add a Prairie Island-Red Wing-Rock Elm-Red Cedar 161 kV line Convert the King-Wissota 115 kV line to 161 kV Convert the Red Rock-Crystal Cave 115 kV line to 161 kV
EAST B	Reconductor Wissota-T Corners-Wien 115 kV line with 795 SSAC
EAST C	Convert the Wissota-Sherman Street 115 kV line to 161 kV
EAST D	Add a Jackson-Port Edwards 161 kV line
EAST E	Add a Monroe County-Council Creek 161 kV line Rebuild the Saratoga-Petenwell 138 kV line
EAST F	Add a Genoa-Hillsboro-Kilbourn 161 kV line Convert the Wissota-Sherman Street 115 kV line to 161 kV
EAST G	Add a Jackson-Port Edwards 161 kV line Convert the Wissota-Sherman Street 115 kV line to 161 kV
EAST H	Add a Monroe County-Council Creek 161 kV line Rebuild the Saratoga-Petenwell 138 kV line

May 1989

The Commission issued its Advance Plan 5 Order. The Commission's order gave planning approval to the EAST and WEST transmission plans from the EWU/WWU Interface Study. The Commission recognized that additional analysis was necessary to determine which one EAST/WEST combination should be built. Therefore, the Commission order stated:

> The utilities shall continue the Interface Study to investigate the following: the appropriate amount of transfer capability for planning purposes; the appropriate transmission facility alternatives for increasing transfer capability for planning purposes; and the appropriate allocation among the utilities of the use (benefits) of transfer capability and of the ownership or costs of system improvements that increase transfer capability. Actual ownership of facilities will be decided in future construction cases related to the interface.

1991-1992

Utilities and Commission staff worked on several studies related to the Interface. One study focused on transmission plans that would provide up to 1,800 to 2,000 MW of west-to-east transfer capability (the cost of increasing transfer capability). Another study evaluated the amount and price of west-to-east power purchases of economy power that may be possible (the benefits of lower costs from buying power instead of generating it locally). A third study considered the environmental impact of increasing the west-to-east transfer capability.

The plans included:

Plan 1: Construct King-Green Bay 345 kV line.
Construct Chippewa Falls-Eau Claire 161 kV line.

Plan 2: Construct Chisago-Apple River 161 kV line.
Rebuild Baldwin-Sherman Street to 161 kV.

Plan 3: Convert King-Pine Lake to 161 kV.
Convert Red Rock-Crystal Cave to 161 kV.
Rebuild Baldwin-Sherman Street to 161 kV.

Plan 4: Construct Chisago-Apple River 161 kV line.
Convert King-Pine Lake to 161 kV.
Convert Red Rock-Crystal Cave to 161 kV.
Rebuild Baldwin-Sherman Street to 161 kV.

Plan 5: Construct an Arrowhead-Weston 250 kV DC line.
Rebuild King-Sherman Street for future 161 kV.
Convert Red Rock-Crystal Cave to 161 kV.

Plan 6: Construct King-Weston 345 kV line.
Construct Chippewa Falls-Eau Claire 161 kV line.

Plan 7: Construct Arrowhead-Weston 230 kV line.
Construct Stone Lake-Sheldon 161 kV line.
Rebuild Baldwin-Sherman Street to 161 kV.
Convert Red Rock-Crystal Cave to 161 kV.
Construct Sandstone-Stone Lake 230 kV line.

In its Advance Plan 6 order, issued September 1992, the Commission determined that the costs of increased transfer capability exceed the benefits for levels higher than 1,200 MW. The costs of the transmission plans increase as the amounts of transfer capability increases. The benefits also increase with increases in transfer capability, but

to a lesser degree at higher levels. The Commission gave planning approval to four plans (2, 3, 4, and 6) to provide up to 1,200 MW of transfer capability. The Commission denied Plans 1 and 5 because they did not show economic benefits in excess of costs relative to other plans. The Commission denied Plan 7 (Arrowhead->>Arpin/WESTON<<) because of its significantly greater environmental impact compared to the other plans that provide the same range of transfer capability.

1994-1995

Reliable service, instead of economic power transfers, became the reason for transmission improvements in northwestern Wisconsin. This is because customer electricity use in northern Wisconsin is expected to increase to the point that the existing transmission system would no longer reliably "keep customer lights on."

The utilities completed the Interface Transmission Study Report 3 in January 1995. The report focused on five transmission plans (A through E) that are representative of the basic plans for the Interface. Commission staff reviewed and requested additional information about whether the utilities desired to increase the west-to-east transfer capability beyond the 1,200 MW approved in Advance Plan 6, and the cost of electrical losses. The utilities filed an addendum in August 1995 that provided the needed information. In a letter to the Commission in September 1995, the utilities state that they reached a consensus on two plans that they believe should be carried forward into construction (Plans C and D).

The improvements needed to serve customers in the area reliably are basically the same transmission facilities that were previously proposed in 1991-1992 to increase transfer capability. As such, a secondary incidental benefit of these improvements is that they provide 1,200 MW of west-to-east transfer capability for economy power purchases.

The five plans involve different transmission improvements.

Plan A: Construct Arrowhead-Arpin-Stone Lake-Whitetail-Arpin 230 kV line.

Plan B: Convert King-Pine Lake-T Corners-Sherman Street to 161 kV.
Convert Red Rock-Crystal Cave to 161 kV.
Construct a second Pine Lake-Apple River 161 kV line.
Construct Stone Lake-Bay Front 161 kV line.

Plan C: Construct Chisago County-Apple River 161 kV line.
Construct Stone Lake-Bay Front 161 kV line.

Plan D: Construct Chisago County-Apple River 230 kV line.

Convert Apple-River 161 kV to 230 kV.
Construct Barron-Osprey 230 kV line.
Loop Rush City-Red Rock 230 kV into Chisago County Substation.

Plan E: Construct Sandstone-Washco-Stone Lake-Osprey 230 kV line.

Commission staff reviewed the report and addendum. The cost analysis showed that Plans C and D are at least $20,000,000 less than any other plan (present value analysis of the cost of construction and electrical losses). At the Advance Plan 7 hearing, the utilities sought approval of only Plans C and D. In September 1996, the Commission issued the Advance Plan 7 order on Interface transmission issues that approved Plans C and D for planning purposes, finding them the lowest cost options. The order neither approved nor rejected Plans A, B, and E.

Spring/Summer 1996

Utilities (primarily NSP) performed further electrical and economic (construction and losses) analysis. A hybrid developed that combined aspects of Plans C and D, construct a Chisago-Apple River 230 kV line and construct a Stone Lake-Bay Front 161 kV line. The Hybrid Plan and Plan D electrically perform equally well and are about the same net present value cost. The utilities chose to proceed with construction of the Hybrid Plan because its construction cost estimate was about $10,000,000 less than Plan D.

Fall 1996

NSP and DPC filed a joint application on September 6, 1996, for the Chisago Electric Transmission Line Project to construct a Chisago-Apple River 230 kV line and construct a Stone Lake-Bay Front 161 kV line (dockets 4220-CE-155 and 1515-CE-102).

Spring/Summer 1997

The ability of the electric system to provide reliable service was a major concern in eastern Wisconsin and northern Illinois for summer 1997. Many of the nuclear power plants in the area were out of service including two plants in Wisconsin – the two-unit 1,100 MW Point Beach Nuclear Power Plant and the one-unit 500 MW Kewaunee Nuclear Power Plant. The generation outages affected the transfer capability of the transmission system in two ways: 1) transfer capability diminished without those generation units in service, and 2) there was not enough firm transmission for all utilities to purchase the firm power they needed to meet desired reserve margins.

Fall 1997/Spring 1998

NSP requested the Commission in October 1997 to consider the Stone Lake-Bay Front 161 kV line as a separate project. In November 1997, the Commission granted this request and established a separate docket for the Stone Lake-Bay Front Electric Transmission Line Project (docket 4220-CE-157). In December 1997, NSP filed supplemental information for the Gingles Substation, which is a component of the Stone Lake-Bay Front Project; other information pertinent to Stone Lake-Bay Front Project was already provided in the joint application NSP and DPC filed in September 1996. The Commission issued an order in April 1998 that approved construction of the Stone Lake-Bay Front 161/69 kV line on the ROW of an existing 69 kV line.

Spring/Summer 1998

Reliability continued to be a concern in the spring and early summer of 1998. In response to concerns about the reliability of the electric system to provide adequate electric service, 1997 Wisconsin Act 204 was passed and put into effect in May 1998. Among other things, it required the Commission to conduct a study to identify and relieve any constraint on the intrastate or interstate transmission system that adversely affects the reliability of transmission service to electric customers in Wisconsin. The Commission submitted a report on the results of the study to the Wisconsin legislature on September 1, 1998. The study analyzed problems and solutions across the Midwest region, including ones in northwestern Wisconsin and eastern Minnesota. Table A-2 identifies the 12 options.

Table A-2 Regional Transmission Options

ID No	Option Description
1c	Salem-Fitchburg 345 kV North Madison-Fitchburg-Rockdale 345 kV
2e	Prairie Island-La Crosse-Columbia 345 kV
2f	Salem-Paddock 345 kV
3e	Arrowhead-Weston-South Fond du Lac 345 kV South Fond du Lac-Plano 345 kV
3j	Arrowhead-Weston 345 kV
3k	Arrowhead-Weston 230 kV
5a	Chisago-Apple River-Weston 345 kV
6c	Chisago-Rocky Run 500 kV Rocky Run-South Fond du Lac 345 kV
8b	Wilmarth-Byron-Columbia 345 kV
9a	Huron-Split Rock-Lakefield Jct-Adams 345 kV Adams-Genoa-Columbia 345 kV
12	Plano-Plano Tap 345 kV
13c	Arrowhead-Plains 345 kV Morgan-North Appleton 345 kV

The executive summary of the study/report is reproduced in Appendix C. Full copies can be obtained by calling Gail Hanson of the Public Service Commission at (608) 267-2896.

Fall 1998

As described in Chapter 2, in the fall of 1988, the utilities, Commission staff and others began to perform detailed analysis of the 12 regional transmission options. Based on a number of factors, 8 of the 12 options were eliminated, but variations of two options have been added. Table A-3 lists the six remaining options:

Table A-3 Regional options being analyzed in detail

Option No.	Option Description
1c	Salem-Fitchburg 345 kV
2e	Prairie Island-La Crosse-Columbia 345 kV
3j	Arrowhead-Weston 345 kV
5a	Chisago-Weston 345 kV
5b	Chisago-Weston 230 kV
9b	Lakefield-Adams-Genoa-Columbia 345 kV

Computer models tested each option's electrical performance with respect to phase angle, voltage, and dynamic stability. In addition, further economic and environmental analysis is being performed. The analysis is expected to be complete by March 31, 1999

Appendix B

Appendix B - Environmental Aspects of the System Alternatives

This section describes the three system alternatives to the Chisago Transmission Project. The Wisconsin utilities and the Commission investigated these alternatives in Advance Plans 5, 6, and 7. Because the MEQB was interested in conducting its own investigation of the alternatives, the Wisconsin Commission decided to include a detailed discussion of the three alternatives in this EIS.

How the System Alternatives Were Analyzed

The analysis of the cost, engineering, and potential environmental impacts of the system alternatives is based on a "reference centerline" between two termination points. The reference centerline may not necessarily be the "optimal route" between the termination points, but it represents a "reasonable route" based on the information available. The MEQB and the PSC used the same reference centerlines for each of the system alternatives in their analyses.

Use of a reference centerline for analyzing system alternatives has both advantages and disadvantages. A reference centerline provides the utility and regulatory agencies with a "route option" that can be used to estimate costs, reliability and potential environmental effects. However, because the applicants did not conduct a detailed corridor study of the "reference centerlines" the information available for analysis is limited. For example, detailed land cover and land use data, number of homes near the proposed centerline, line and substation design options and costs are not available. Landowners along the reference centerline have not been notified of the proposed project, so they have not had an opportunity to raise local issues and concerns or provide comments on other aspects of the project. **The reference centerlines are not routes that could be approved by the Commission or the MEQB for the Chisago Transmission Project.** Rather, use of reference centerlines allows the MEQB and the Commission to compare the Chisago to Apple River system alternative to the others at a more similar scale of analysis.

Rock Creek to Apple River

This alternative involves a 161 or 230 kV transmission line extending from the Rock Creek Substation to the Apple River Substation. The reference centerline follows a DPC 69 kV line for most of the distance between Grantsburg and the Apple River Substation and another 69 kV line owned by Northwestern Wisconsin Electric Company (NWEC) between Grantsburg and the Rock Creek Substation in Minnesota. This alternative would not eliminated the need for the 115 kV line from the Chisago Substation to Taylors Falls, MN and the need for the new Lawrence Creek Substation.

Using the proposed reference centerline, this system alternative would result in a 161 kV or 230 kV line that would be about 52 to 54 miles long. The line would cross the St. Croix National Scenic Riverway at or near the STH 70 bridge. NSP has an easement on the south side of the bridge that crosses the river and the adjacent lands managed by the National Park Service. About 3 miles of line would be located in Minnesota adjacent to STH 70 in the Town of Rock Creek. West of the Chengwatana State Forest, the land adjacent to STH 70 consists of a series of low wet areas interspersed with farmland. In Wisconsin, the area the line would pass through is primarily rural, consisting of many small farms, scattered lakes and several large blocks of woodlands and wetlands. The communities of Grantsburg, Trade River, Atlas, and Frederic are located along or near the reference centerline.

St. Croix River Crossing

The river lies in a valley that is approximately one mile across from ridgetop to ridgetop. Approximately 400 feet of land on both sides of the river is owned by the U. S. Department of the Interior and managed by the National Park Service. The Governor Knowles State Forest lies adjacent to the St. Croix Riverway in Wisconsin and the Chengwatana State Forest abuts the federally owned land in Minnesota. Canoe and fishing are the primary uses of the Riverway in this area. The Marshland Visitor Center, operated by the National Park Service, is located on the Minnesota side of the river on the north side of STH 70. A new transmission line crossing the St. Croix River at this location would have to be permitted by the U.S. Army Corps of Engineers and any new easements necessary would have to be negotiated with the National Park Service.

Aesthetic impacts from the surface of the river and on the view of the river from the surrounding landscape are the primary concerns of the National Park Service and the Upper St. Croix Management Commission. This section of the river receives much use because of the existing facilities, which include several canoe landings, a boat landing, the picnic facilities and the visitor center. Ongoing development of a large campground on the east side of the river will increase public use of the area in the future.

A gas pipeline owned by Northern Natural Company occupies a portion of the existing NSP easement across the riverway. The pipeline was bored under the river in the mid 1980's and the cleared ROW overlaps the highway ROW. An NWEC 69 kV line from the Rock Creek Substation to Grantsburg was authorized in 1995. This power line was bored under the St. Croix River on the north side of the STH 70 bridge in 1997. The line approaches the river from the west as an overhead line and the transition structure (changing the line from an overhead line to an underground facility) is about 300 feet from the river's edge near the driveway entrance to the National Park Service Visitor Center. The line continues underground for about 300 feet on the east side of the St. Croix River before changing back to an overhead line. Because the transmission line was placed on the north side of the STH 70 bridge, an easement had to be obtained from the National Park Service.

An overhead transmission line on the south side of the bridge would be highly visible when driving over the bridge, from the Marshland Visitor Center and from a picnic area on the East Side of the river. An overhead line would also require the removal of a significant number of trees on both sides of the river. A wooded buffer exists on the Minnesota side between the highway ROW and the gas pipeline ROW. Removal of additional trees from this buffer for a power line would create a significant visual impact in this area. Also, a wayside/picnic facility managed by the Wisconsin Department of Transportation (DOT) is present on the Wisconsin side of the river. Several mature white pine trees would need to be removed to make room for an overhead line. In addition, the ROW clearing required would have a substantial adverse visual impact on a new DNR campground being developed in Governor Knolls State Forest just east of the Riverway.

The potential for an underground 161 kV or 230 kV line may be somewhat limited by the facilities already present under the riverbed. Replacing the existing 69 kV line with a higher voltage line may not be technically feasible due to the larger size cable and the need for redundant facilities (see Chapter 5). Also, the existing ROW width would need to be increased, requiring a new easement from the National Park Service. The transition structures needed for undergrounding a high voltage line would be much larger than the transition poles for the 69 kV line.

Another option that was considered during the siting of the 69 kV line and may be feasible for a higher voltage line is attaching the line to the underside of the STH 70 bridge. The line would be placed in metal trays in the lower bridge deck. No cables

would be exposed or hang from under the bridge. The transition stations would have to be located some distance from the bridge and the conductors would have to be trenched in toward the river to the bridge abutments and drilled through the abutments. The Wisconsin DOT has some safety and maintenance concerns about mounting the line on the bridge deck. Since sections of the underside of the deck are currently accessible to the general public, the cable would be vulnerable to vandalism or ice jams that sometimes occur under the bridge in late winter or early spring. A ROW on the north or south side of the highway could be used for this crossing design, but either would result in a substantial visual impact due to the need to clear a large number of trees.

General Land Use Impacts

West of the St. Croix River, a new high voltage line could probably be double-circuited with the existing 69 kV line in the same ROW adjacent to STH 70. The primary environmental impacts would be visual impacts and short-term construction impacts. Some additional clearing may be needed, but the existing ROW passes mostly through open farmland and wetlands with emergent vegetation. Few homes are present along the 3-mile stretch between the Rock Creek Substation and the crest of the river valley. There is room at the Rock Creek Substation to add an additional transformer and other equipment that might be needed without expanding the fenced in area.

East of the St. Croix River, the reference centerline largely follows the ROW of other existing transmission or distribution lines. Between the St. Croix River and the village of Grantsburg, the centerline would pass through about 1.3 miles of the Governor Knowles State Forest and several private landholdings within the state forest. The existing ROW would need to be widened requiring new easements from the DNR and several landowners. The siting of the 69 kV line through this area several years ago was quite controversial and it is assumed that many of the same concerns and issues would arise when trying to acquire new easements.

Further to the east the reference centerline skirts through the western and southern edge of the village of Grantsburg and extends south along STH 48 passing the Fish Lake State Wildlife Area. This property consists of large areas of open water interspersed with open fields, northern sedge meadow and shallow marsh. Waterfowl concentrate in this area during migration periods and some species commonly nest here. A high voltage transmission line on tall steel structures could pose as a hazard for birds during low light or foggy conditions.

The reference centerline continues south to the Polk-Burnett county line where it turns due east and runs cross-country for most of the next ten miles through the communities of Atlas and Pole Cat Crossin to a point one mile south of Frederic. From this point, the reference centerline travels south and east toward County Trunk I near Bone Lake. It continues south on CTH I and CTH H for ten miles and then follows the DPC 69 kV line southeast around Shiloh Lake to USH 8. From USH 8 the centerline follows the 69 kV line ROW to the Apple River Substation.

Although the reference centerline uses existing transmission and distribution line corridors over most of the 50 plus mile distance between Rock Creek and Apple River, the existing ROWs would have to be widened significantly (40 to 60 feet) to allow double-circuiting or construction of a 161 kV or 230 kV transmission line in the corridor. The centerline passes adjacent to or near many small lakes and crosses the Apple River, Fox Creek, Straight River, the Trade River, and several other small creeks and wetlands. Also, much of the existing ROW between Trade River and Bone Lake is not adjacent to roads. The impacts associated with construction and clearing, such as soil compaction and erosion, destruction of crops, vegetation, and wildlife habitat, could be much greater than if access from a road is possible.

Impacts on Special Resources

Natural Heritage Inventory records indicate that several state and federally listed species occur along or within close proximity to the reference centerline. Bald eagle nest sites are present on and near the centerline. Ospreys (*Pandion haliaetus*) have also been observed nesting in the area. The Fish Lake Wildlife Area provides habitat for several rare birds and plants. Also, the Karner blue butterfly (*Lycaeides melissa samuelis*), a federally endangered butterfly, has been sighted in the wildlife area in recent years.

Specific information about potential impacts related to historical and archeological sites, acres of forest and wetland affected, the number of fields crossed and specific concerns of the local communities located along the reference centerline is not available at this time.

King to Apple River and Red Rock to Crystal Cave

This system alternative would involve rebuilding the existing 161 kV line from the A. S. King Power Plant in Bayport, Minnesota to Hydro Lane Substation in Chippewa Falls, building a new 161 kV line from the Pine Lake Substation to the Apple River Substation and rebuilding the Red Rock to Crystal Cave 161 kV line. (The Baldwin-Marathon City Transmission Project, approved by the Commission in 1996, authorized NSP to reconductor the 115 kV line between the Pine Lake Substation and the Hydro Lane Substation. However, to enable the line to be operated at 161 kV, NSP has

indicated that the existing structures and insulators would also need to be replaced.) Altogether, approximately 135 miles of transmission line construction including two crossings of the St. Croix National Scenic Riverway would be needed. All of the construction, with the exception of the new 26-mile long 161 kV line from Pine Lake to Apple River would occur in existing transmission line ROWs. This alternative would not eliminate the need for the 115 kV line from the Chisago Substation to Taylors Falls, MN and the need for the new Lawrence Creek Substation.

Potential Environmental Impacts

Two St. Croix River Crossings

The existing 115 kV crossing north of Hudson extends from the A.S. King plant across the Lower St. Croix River to the community of North Hudson. This line, built in 1965, is mounted on steel lattice towers about 212 feet tall. The tower on the Minnesota side of the river is on the riverbank directly east of the power plant. On the Wisconsin side, the main support tower is on a small peninsula supporting a boat landing and picnic area. The 115 kV line shares the steel towers with another circuit that operates at 23 kV, but is insulated to 161 kV specifications. The two circuits split into two separate corridors in Wisconsin that climb eastward up a steep wooded bluff.

The other existing 115 kV crossing that would need to be rebuilt is located about seven miles south of Hudson and about one mile south of Afton, MN. The St. Croix River is very wide at this location and the river valley is heavily wooded on both sides of the river. Rebuilding this crossing would be a difficult undertaking due to lack of easy accessibility to the existing structures and the river. Because this section of the river and the surrounding countryside is very scenic, there would be aesthetic concerns associated with rebuilding the line for a higher voltage at this time and retaining the possibility of adding another circuit in this corridor in the future.

The continuing development and use of underground transmission technologies should result in these technologies becoming more affordable and less environmentally risky in the future. Because of the scenic nature and relatively undeveloped setting at this location, the possibility of changing this overhead crossing to an underground line should be considered if and when the line needs to be rebuilt.

The potential impacts on threatened or endangered species at the crossing south of Hudson include several rare mussels, such as the Higgins 'Eye Pearly mussel, a federally endangered species and several rare plant species.

General Land Use Impacts for A. S. King to Wissota/Hydro Lane

The 76-mile long 115 kV line from the river to the Pine Lake Substation and beyond to the Wissota/Hydro Lane Substation near Chippewa Falls is mounted on alternating steel lattice towers and wood wishbone structures. In areas where longer spans are needed, wooden H-frame structures have been used. The land is primarily rolling east

of the steep wooded slopes adjacent to the river. The landscape becomes much hillier in Dunn County and the land use shifts from primarily agriculture to a more even mix of agriculture and forest. Several large forest blocks occur on ridges and steep slopes. Extensive wetlands are present adjacent to some of the rivers crossed by the existing ROW, including Tiffany Creek, Hay River, and Duncan Creek. The area surrounding Hudson and North Hudson is growing rapidly and residential development is replacing much of the farmland.

NSP owns most of the 115 kV line ROW between the St. Croix River and the Hydro Lane Substation and it likely that little or no new ROW would be needed if the line is rebuilt and converted to 161 kV operation. When authorizing the Baldwin-Marathon City Project, the Commission ordered NSP to reroute a short section of the existing line that crossed the Hay River and bordered the Hay River Public Hunting Grounds.

Most of the existing transmission line ROW runs cross-country over the 76-mile distance from the river to Chippewa Falls. One of the primary impacts expected would be the potential for short-term damage to agricultural lands, including soil compaction and crop damage, resulting from construction. Little or no clearing would be required in wooded areas, but construction activities on steep slopes could lead to soil compaction and erosion.

Impacts on Special Resources for A.S. King to Wissota/Hydro Lane

In addition to the Hay River Public Hunting Grounds, the line crosses or borders several other public lands and public recreation areas. These areas include the tip of Willow River State Park, Three Lakes National Waterfowl Production Area, the Hay Creek State Fishery Area, and Pine Lake County Park. Impacts in these areas range from aesthetic concerns to the potential for bird-wire collisions during low light and fog conditions. Bald eagles, a federally listed species, have been observed in the Hay Creek Public Hunting Grounds.

General Land Use Impacts for Red Rock to Crystal Cave

This section of 115 kV line is about 35 miles long and passes through open rolling terrain on both sides of the Lower St. Croix River. About 10 to 12 miles of line lie west of the St. Croix River in Minnesota, with the remainder located in Wisconsin. The primary land use is agriculture, although numerous small woodlots, wetlands, and dry prairies are interspersed throughout the area.

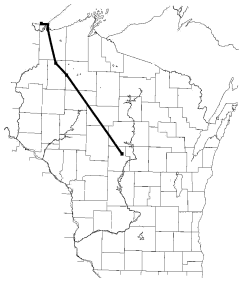
The line, which was originally built in 1950, was reconductored in 1983. The existing structures are wood H-frames with steel cross arms. Rebuilding the 115 kV line to 161 kV specifications could likely be completed within the existing ROW. No new easements would be needed unless the existing alignment is modified.

Impacts on Special Resources for Red Rock to Crystal Cave

Public lands that are present along or near the 115 kV line include the Kinnickinnic River State Fishery Area and Minnesota Interstate Park. The line crosses the Kinnickinnic River, the Rush River and many small drainage ways and creeks as it passes through the hilly countryside.

Several state-listed plant species associated with dry bluff prairies are present along the existing transmission line and the red side dace (*Clinostomus elongatus*) has been observed in the Rush River.

Specific information about potential impacts related to historical and archeological sites, acres of forest and wetland affected, the number of fields crossed and specific concerns of the local communities located along the reference centerline is not available at this time.



Arrowhead to Arpin

The Arrowhead-Arpin system alternative involves a 230 kV transmission line extending from the Arrowhead Substation, six miles west of Duluth, MN to the Arpin Substation near Marshfield, WI. The total distance between the termination points is approximately 210 miles. The reference centerline generally follows a northwest to southeast path along existing transmission line ROWs, gas pipelines or railroad corridors. Some of the large communities located on or near the reference centerline include Duluth, MN, Superior, Solon Springs, Hayward, Ladysmith, Owen, and Marshfield. Many small unincorporated communities are also present along the route. This system alternative would not eliminate the need for a 115 kV line from the Chisago Substation to the Taylors Falls, MN area or the new Lawrence Creek Substation in Taylors Falls.

Potential Environmental Impacts

River Crossings

The reference centerline crosses five rivers of major significance in Wisconsin as it passes through northwestern Wisconsin. It crosses the St. Louis River south of the cities of Duluth, MN and Superior, WI. The St. Louis River valley is well defined; a

new transmission line would lose 400 feet in elevation between the Arrowhead Substation and the river. The crossing of the St. Croix River would occur about six miles east of the Gordon Dam near Gordon, WI. This section of the river is not part of the St. Croix National Scenic Riverway. However, further south near Hayward, the reference centerline crosses the Namakagon River, which is managed as part of the St. Croix National Scenic Riverway. The new 230 kV line could be double-circuited with or placed adjacent to an existing transmission line at all of these crossings or special consideration could be given to the crossing of the Namakagon River because of its significance as part of the St. Croix National Scenic Riverway. Undergrounding one or both of the lines at this location should be considered.

The Chippewa River and the Flambeau River are also crossed by the reference centerline. The Lakehead gas pipeline and a railroad bridge on the Chippewa River provide some opportunities to corridor-share at these locations. However, in general, corridor-sharing with gas pipelines is less favorable with respect to mitigating environmental damage because of the distance required between the electric and gas facilities (see Chapter 5, South-Washington Route).

Finally, the reference centerline crosses the Black River and the Popple River system south of the community of Owen. While these rivers do not have special designations or are not as large as some of the other rivers crossed by the reference centerline, they have unique characteristics that warrant special consideration. The Black River is very scenic and sections of it are heavily used by canoeists and boaters. South of STH 29, the Popple River system is divided into several forks and an extensive network of wooded wetlands surrounds the streams.

General Land Use Impacts

Over the 210-mile distance between Arrowhead and Arpin the vegetative cover and land use vary considerably. The portion of the reference centerline north of Ladysmith, WI passes through areas that are mostly forested with numerous scattered wetlands. Some of these wetlands are part of large complexes consisting of shallow and deep marsh, wooded wetlands, shrub carr, and northern sedge meadow. Large wetland complexes are present south of Superior, north and west of Hayward, and southeast of Stone Lake. Many of the forests and wetlands are publicly owned and provide opportunities for recreation and timber harvesting. Farms are relatively small compared to those in central and southern Wisconsin. Two commercial cranberry operations are present along the reference centerline in this northern area.

South of Ladysmith, the landscape is much more open and agriculture, specifically dairy farming, is the predominant land use. Pastureland, hay, alfalfa, and row crops are common throughout the area. Potential impacts to this farmland include crop damage and soil compaction due to construction activities, and possible long-term effects on agricultural operations if a new transmission line corridor is routed across fields. Interference with irrigation and aerial spraying, loss of crop yield at pole locations,

difficulty in maneuvering machinery around poles, and weed encroachment from the areas around the base of poles are some of the potential long-term impacts.

It has been noted that there are several corridor-sharing opportunities along much of the 210-mile distance between Arrowhead and Arpin. These corridors are primarily existing transmission lines and railroad and pipeline ROWs. While existing transmission lines would allow double-circuit options or overlapping corridors for the new high-voltage line, in most cases the existing ROW would have to be widened substantially.

Corridor-sharing with gas or oil pipelines often results in little reduction of the impacts caused by transmission line construction and operation. This is especially true in agricultural areas that are row-cropped. Whereas the effects of a pipeline may not be discernible several seasons after construction, the placement of a new overhead transmission line diagonally across cropped fields may have significant long-lasting effects on farm operations. In forest and wetland areas, the distance required between the gas and electric facilities would likely result in a need for ROW expansion, and consequently much forest habitat loss. Although the clearing would be an incremental impact rather than a new corridor, the "edge effects," such as increased wind and light penetration and encroachment of weedy species, would further degrade the remaining forest. (Several recent literature studies indicate that the edge effects in forest areas may extend up to 200 meters into a forest.)

Finally, in urban areas and rural upland areas, overlapping transmission line ROWs with railroad corridors can provide a reasonable opportunity for minimizing impacts. However, when crossing wetlands, railroad corridors tend to be located on narrow berms that are not wide enough to accommodate electric transmission structures, thereby resulting in pole placement in the wetlands. Also, many railroad corridors crossing large undeveloped areas, such as those present north of Ladysmith, have limited accessibility. Building a new high-voltage transmission line next to the railroad could require construction of long access roads through wetlands resulting in major adverse impacts on wetland soils and vegetation. Also, some of the best high-quality prairie remnants remaining in Wisconsin are found in upland areas adjacent to railroads. The potential for finding mesic prairie remnants along the reference centerline in central Wisconsin could be quite high.

Impacts on Special Resources

Numerous public lands are located along the reference centerline. A partial listing of these includes: Douglas County State Hunting Grounds, Flat Creek Wildlife Area, the Brule River State Forest Annex, Beverly Lake State Wildlife Area, Hauer Springs State Wildlife Area, and Pershing State Wildlife Area. Many of these state wildlife areas function as valuable waterfowl production sites. The potential for habitat loss due to the need for additional ROW clearing and bird-wire collisions during low light and fog conditions exists at these locations.

Many rare plants and animals are present along or near the reference centerline. Among others, these species include ospreys, several rare butterflies, three federally-listed species, the timber wolf, bald eagle, and Karner blue butterfly and some uncommon ecosystems, such as soft-water acid bogs and pine barrens.

Appendix C

Appendix C - Executive Summary of the Report on the Regional Electric Transmission System

The analysis investigated 50 sets of transmission . . .improvements. . . then concentrated on 12 representative options.

This report to the Wisconsin Legislature on the adequacy of the region's electric transmission system fulfils the requirements under 1997 Wisconsin Act 204 (Act 204). The report represents the efforts of a large and diverse group of interested parties over a relatively short period of time and is intended to identify transmission constraints on the regional bulk power transmission system and to identify possible solutions to relieve those constraints. The analysis investigated 50 sets of transmission system improvements with new transmission lines ranging in voltage from 138 kV up to 765 kV, lengths up to 560 miles, and costs of more than $250 million. The analysis then concentrated on 12 representative options.

Infrastructure improvements will be necessary. . . .

The high-voltage bulk power transmission system in the Midwest was essentially designed and built in a period extending into the 1970s and has not experienced any significant additions or upgrades since that time. Events of the summers of 1997 and 1998 have demonstrated that the system is no longer capable of sustaining the power transfers necessary to maintain the reliability that consumers have experienced in the past and have grown to expect. Changes in the use of the system and growing uncertainty of nuclear unit availability have placed excessive strain on the transmission system. Infrastructure improvements will be necessary to restore and maintain acceptable reliability of the interconnected network.

This study presents a number of system enhancements that will mitigate identified constraints and provide a simultaneous power transfer capability into Wisconsin of 3,000 MW (megawatts); either 2,000 MW from the west and 1,000 MW from the south, or 1,000 MW from the west and 2,000 MW from the south. The focus of this study was to screen many possible options to determine those warranting further examination rather than to identify a single solution. The potential impacts of each option have not been fully evaluated in this first phase of study. More detailed examination of the impact of new transmission lines and the impact of additional generation expansion must be performed. All identified options may require additional facilities based on more detailed analysis. In addition, the sensitivity of this study's

findings to factors such as load, generation patterns, and simultaneous transfers, may also indicate the need for additional facilities.

Benefits of Interconnected Systems

The development of electric transmission systems allowed power plants to be linked to serve cities, metropolitan areas, states, and, ultimately, large multi-state regions. The growth of interconnections within the power system enabled utilities to take advantage of the diversity of electricity demand and generation between different parts of the power system, thus enhancing reliability. By sharing generation resources with neighboring utilities experiencing particularly high demand or a power plant outage, utilities can reduce required generation reserve margins throughout the system. These interconnections also enabled ever-larger transfers of power between areas and allowed utilities to take advantage of distant low-cost generation. Through most of the history of the electric utility industry, increasing interconnections have increased reliability and decreased electricity prices.

Wisconsin's Reliability Situation

Increased transmission transfer capability into eastern Wisconsin is required to ensure that utilities can continue to meet customer demands in spite of power plant outages.

With all generating units in operation, eastern Wisconsin utilities have sufficient generating capability to meet their customers' electricity demands. As the events of the last two summers indicate, however, unexpected problems can force generators out of service, threatening reliability. Increased transmission transfer capability into eastern Wisconsin is required to ensure that utilities can continue to meet customer demands in spite of power plant outages. Accordingly, the required amount of transmission transfer capability depends on the degree of reliability desired. The reliability standard historically used in Wisconsin and in the region is such that the loss-of-load expectation (LOLE) is no more than 1 day in 10 years or 0.1 day per year. This reliability standard, combined with new generation uncertainty and uncertain existing nuclear plant availability, supports an increase in transfer capability into Wisconsin to 3,000 MW, an approximate doubling of today's transmission transfer capability.

Transmission Constraints Identified

Identify constraints

A computer model of the Midwest electric transmission system for the year 2002 was used to find problems and test potential solutions. The analysis simulated the outage of transmission facilities to determine which other facilities would overload. As power transfers are simulated from the west or south into Wisconsin, the transmission system is stressed more and problems were identified.

Wisconsin

One of the most important limitations to power transfer from the west . . . is . . . the need to limit east-west phase-angle differences.

Virtually all of the transmission options considered were found to be limited by line overloads in the Eau Claire area and elsewhere throughout Wisconsin. One of the most important limitations to power transfer from the west, however, is not due to facility overloads, but to the need to limit east-west phase-angle differences.[2]

Northern Illinois

Serious overload problems in the Commonwealth Edison (CE) northern Illinois transmission system appeared in the study base case and nearly all transmission option scenarios. Because transfers from western and southern generation sources flow, in part, through the CE system, these problems pose a significant transfer limitation.

Transmission Reinforcement Options Considered

Fifty transmission system reinforcement options were examined to determine their impact on transfer capability into eastern Wisconsin. The starting point for selection of these options was the list of transmission lines proposed in the Wisconsin utilities '1997 report to the Governor on electric reliability.

The list of options was further broadened to ensure that no class of potential solutions was overlooked. Additions included other new high-voltage transmission lines, construction of several relatively short lower-voltage lines, direct-current (DC) lines under Lake Michigan, and an option consisting of a single new line less than 30 miles long in conjunction with multiple upgrades of existing equipment. Consideration was also given to addressing the western interface phase-angle problem by the use of power control technology.

Additional options were developed through minor modification and refinement. For each set of new transmission lines, some upgrades of existing lines and equipment were required to allow each option to reach the target transfer potential. In this manner, the "long list" of transmission reinforcement plans, each comprising both new transmission lines and a number of upgrades, was found. This long list is detailed in Appendix I. The long list of options was narrowed to a short list of 12 options.

Electrical analysis

To be on the short list, options needed to provide 3,000 MW of simultaneous transfer capability into eastern Wisconsin; either 2,000 MW from the west and 1,000 MW from the south, or 1,000 MW from the west and 2,000 MW from the south. A lower phase

[2] Technical discussion of this problem is presented in Chapters 3 and 4.

angle between eastern and western Wisconsin at the Arpin Substation when the Eau Claire-Arpin 345 kV line is out of service is also an important electrical factor. Lastly, the amount of electrical losses is a factor that affects the efficiency of the electrical system and the cost of electricity. Future analyses of the options may determine that one or more of these options may need to be implemented to achieve the desired transfer level.

The following map, Figure ES.1, illustrates the length and location of the short list of options. The Cook-Zion submerged cable shown on the map is an alternative to the Plano-Plano Tap 345 kV line (option 12).

Economic analysis

The engineering analysis in this study did not limit or reject options based on cost. For the purposes of option comparison and guiding future policy and study directions, preliminary capital cost estimates were developed for each short-list option after the technical performance was determined (see Table ES.1).

The cost of electrical losses of the options, relative to each other, could amount to millions of dollars. However, no attempt was made to calculate the cost of losses in this report. This is because project details, line loadings, and physical characteristics cannot be accurately determined until more detailed studies are completed. Also, the study considered a single time slice, dispatch pattern, and load level. More system conditions must be studied to better estimate line losses.

Environmental impacts

The environmental and social issues and impacts associated with any of the identified bulk transfer transmission lines are likely to be significant.

The environmental and social issues and impacts associated with any of the identified bulk transfer transmission lines are likely to be significant. All the proposed solutions for increasing transfer capability into eastern Wisconsin will require the participation of not only landowners, utilities, and regulators in Wisconsin, but also landowners, utilities, and regulators in surrounding states. History has shown that construction of any high-voltage transmission line will be controversial. Construction of new transmission lines associated with the options analyzed in this report may lead to significant environmental impacts.

The nature and severity of environmental impacts will vary depending on what part of the state is involved. Regardless of location, private land will be required for any transmission line. The use of private land may require the exercise of eminent domain.

Figure ES.1 Potential options– regional map

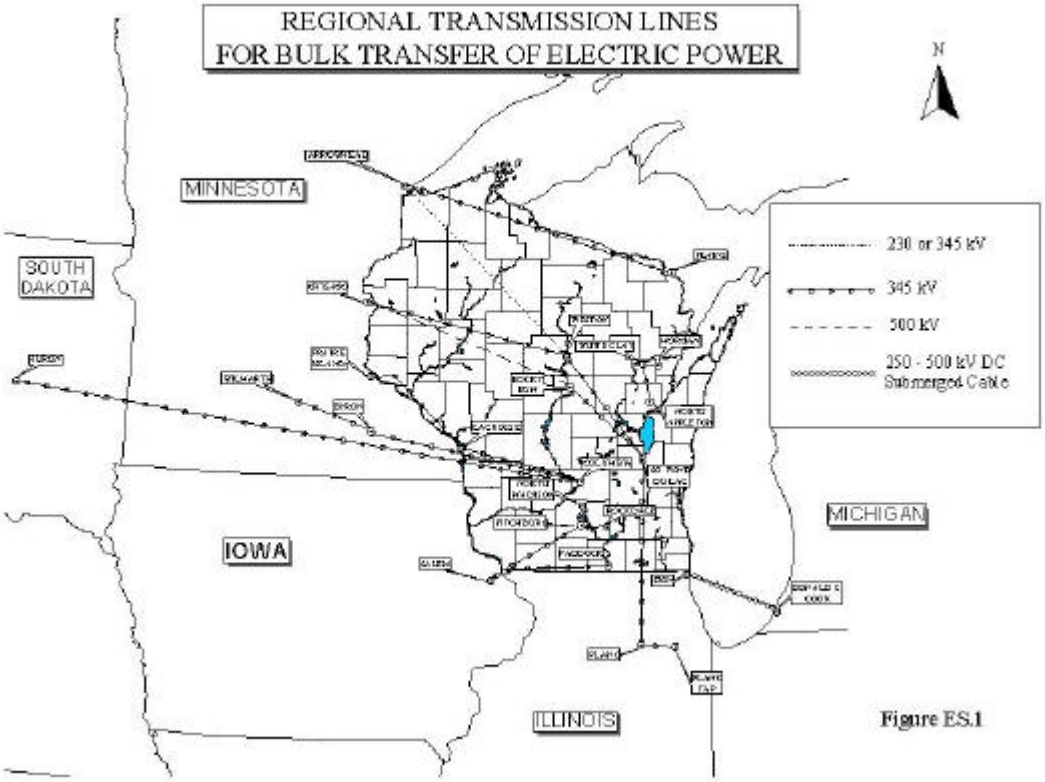


Figure ES.1

Landowners, by law, will receive an easement payment for transmission right-of-way (ROW) on their property that reflects the fair market value of the land at the time the easement is procured. Eminent domain comes into play only after the Commission approves a project and landowners and utilities are unable to reach agreement on terms.

Summary of Study Results

Electrical and cost characteristics of the short-list options are summarized in Table ES.1.

Table ES.1 Short list of options and their characteristics

		Transfer Capability					
	Option Description [1]	Western Sources (MW)	Southern Sources (MW)	Construction Capital Cost (millions) [2]	Length (Miles)	Arpin Phase Angle [3]	Losses [4] (MW)
1c	Salem–Fitchburg 345 kV No. Madison-Fitchburg-Rockdale 345 kV Plano-Plano Tap 345 kV	2,220	2,040	$123	145	92°	486
2e	Prairie Island-LaCrosse-Columbia 345 kV Plano-Plano Tap 345 kV	2,121	2,279	$138	210	78°	475
2f	Salem–Paddock 345 kV Plano-Plano Tap 345 kV	1,980	1,960	$94	95	95°	504
3e	Arrowhead-Weston-South Fond du Lac 345 kV South Fond du Lac-Plano 345 kV	2,160	2,020	$181	490	65°	452
3j	Arrowhead-Weston 345 kV Plano-Plano Tap 345 kV	2,100	2,050	$139	230	70°	444
3k	Arrowhead–Weston 230 kV Plano-Plano Tap 345 kV	2,160	2,000	$118	230	83°	470
5a	Chisago-Apple River-Weston 345 kV [5] Plano-Plano Tap 345 kV	2,276	2,136	$149	210	48°	449
6c	Chisago-Rocky Run 500 kV Rocky Run-South Fond du Lac 345 kV Plano-Plano Tap 345 kV	2,393	2,150	$212	320	38°	410
8b	Wilmarth-Byron-Columbia 345 kV Plano-Plano Tap 345 kV	2,090	1,970	$143	245	80°	481
9a	Huron-Split Rock-Lakefield Jct-Adams 345 kV Adams-Genoa-Columbia 345 kV Plano-Plano Tap 345 kV	2,572	2,412	$263	530	72°	440
12	Plano-Plano Tap 345 kV	1,910	1,710	$59	25	99°	510
13c	Arrowhead-Plains 345 kV Morgan-North Appleton 345 kV Plano-Plano Tap 345 kV	2,250	2,070	$165	320	77°	459

[1] All options contain additional facilities which are detailed in Appendix H Table H.2.
[2] Costs shown are estimated capital investment in 1998 dollars.
[3] Arpin Substation is located south of Marshfield, Wisconsin. A phase angle of less than 60 degrees is desirable because it eliminates the need for cumbersome operating procedures.
[4] Losses of options were calculated with a simultaneous transfer of 1,000 MW from the west and 1,000 MW from the south. The figures in the table are losses relative to base case conditions without transfers.
[5] This line replaces the Chisago-Apple River 230 kV line which is assumed in service in all other options.

For illustrative purposes only, each of the 12 options were rated as GOOD, FAIR, or POOR, relative to each other, for 4 criteria as shown in Table ES.2

Table ES.2 Comparative overview of the short list of options

#	Option Description	Construction Capital Cost ($ millions)	Length (Miles)	Arpin Phase Angle [1]	Losses [2] (MW)
1c	Salem–Fitchburg 345 kV No. Madison-Fitchburg-Rockdale 345 kV Plano-Plano Tap 345 kV	◐	●	○	○
2e	Prairie Island-LaCrosse-Columbia 345 kV Plano-Plano Tap 345 kV	◐	◐	◐	◐
2f	Salem–Paddock 345 kV Plano-Plano Tap 345 kV	●	●	○	○
3e	Arrowhead-Weston-South Fond du Lac 345 kV South Fond du Lac-Plano 345 kV	◐	○	◐	◐
3j	Arrowhead-Weston 345 kV Plano-Plano Tap 345 kV	◐	◐	◐	◐
3k	Arrowhead–Weston 230 kV Plano-Plano Tap 345 kV	◐	◐	○	◐
5a	Chisago-Apple River-Weston 345 kV Plano-Plano Tap 345 kV	◐	◐	●	◐
6c	Chisago-Rocky Run 500 kV Rocky Run-South Fond du Lac 345 kV Plano-Plano Tap 345 kV	○	◐	●	●
8b	Wilmarth-Byron-Columbia 345 kV Plano-Plano Tap 345 kV	◐	◐	○	○
9a	Huron-Split Rock-Lakefield Jct-Adams 345 kV Adams-Genoa-Columbia 345 kV Plano-Plano Tap 345 kV	○	○	◐	●
12	Plano-Plano Tap 345 kV	●	●	○	○
13c	Arrowhead-Plains 345 kV Morgan-North Appleton 345 kV Plano-Plano Tap 345 kV	◐	◐	◐	◐
		Construction Capital Cost ($ millions)	Length (Miles)	Arpin Phase Angle [1]	Losses [2] (MW)
●	Good	0-100	0-200	38-59°	410-442
◐	Fair	101-200	201-400	60-79°	443-476
○	Poor	201-300	401-600	80-99°	477-510

[1] Arpin Substation is located south of Marshfield, Wisconsin. A phase angle of less than 60 degrees is desirable because it eliminates the need for cumbersome operating procedures.

[2] Losses of options were calculated with a simultaneous transfer of 1,000 MW from the west and 1,000 MW from the south. The figures in the table are losses relative to base case conditions without transfers.

A detailed discussion of generation is not included in this report. While the focus of this report is to increase transmission transfer capability, the PSCW also recognizes and regularly reviews the need for generation. In the fall of 1997, the Commission ordered three utilities to procure 500 MW of new generation. In addition, Act 204 lifted legal barriers to encourage merchant power plants to be built in Wisconsin. To date, these two actions have resulted in commitments for over 500 MW of power by 2000 in eastern Wisconsin. The PSCW recognizes that both new generation and new transmission will be needed to provide reliable service to electric customers in Wisconsin.

Findings

Despite the substantial uncertainties and further study that lie ahead, this analysis yielded significant results.

- With the addition of local load-serving transmission facilities expected to be in place by the summer of 2002 (listed in Appendix C), the simultaneous power transfer capability into eastern Wisconsin will be 1,800 to 2,000 MW, which is short of the 3,000 MW target.
- Significant increases into transfer capability above this 1,800 to 2,000 MW level will not be possible unless limits in Commonwealth Edison's northern Illinois transmission network are either fixed by construction of a new 345 kV line in Illinois (approximately $35 million), bypassed by construction of a cable under Lake Michigan ($178 million), or new generation capacity is ultimately sited in northern Illinois.
- Construction of a major new high-voltage transmission line extending into a neighboring state from Wisconsin can achieve the transfer capability goals of the study, increase operating flexibility, and reduce the magnitude of the western interface phase-angle problem. New high-voltage transmission construction identified in the study involves investment from $80 to $250 million for 100 to 500 miles of construction.
- In addition to new high-voltage lines, other transmission facility improvements are needed. These facilities include the local load serving improvements listed in Appendix C. These facilities also include improvements in Wisconsin and northern Illinois, an investment up to $20 million, to upgrade existing facilities to increase transfer capability to desired levels.
- The upgrades and construction described above will lower losses to varying degrees. Generally, the more investment made in new transmission the lower the losses at the same transfer level. However, losses will increase as power transfers increase to make use of the higher

transfer capability provided by the transmission upgrades and construction.

? History has shown that the construction of any high-voltage transmission line will be controversial. Construction of any of the new lines in the options analyzed in this report may have significant environmental impacts.

Next Steps

This study should be regarded as the first step in the process of identifying the most appropriate transmission reinforcement approach to enhance electric reliability in Wisconsin.

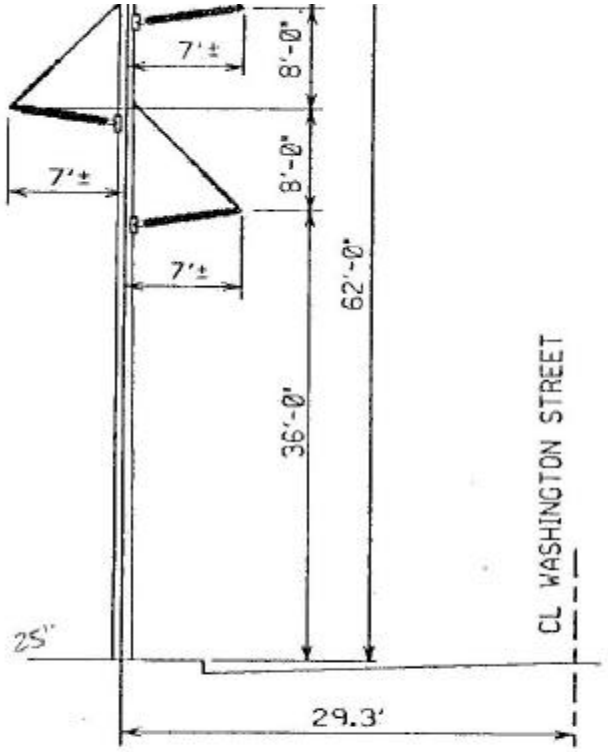
The PSCW and other stakeholders will continue to study some or all of the 12 options in greater detail and to work with neighboring state regulators that have an interest in the reliability of the regional electric transmission system. These studies will lead to the selection of the optimal options and ultimately in utility applications to build those options.

Appendix
D

Appendix D - Diagrams of Proposed Structures

Figure D-1 Low-profile 230 kV HLP

This structure type would be used for an overhead 230 kV line within the city of St. Croix Falls on Segments JJ (Dam-Washington-Louisiana Route) or 101 B and 102 A (Dam-Louisiana-Washington Route).



PROPOSED
230kV SINGLE CIRCUIT
FOUNDATION REQUIRED
USE EXISTING CENTERLINE
60' R/W WIDTH REQUIRED

Steel pole
Foundation 5-6' diameter
Pole base approximately 25"
Foundation height above grade--1

Figure D-2 Low-profile 230 kV HLP with 69 kV Underground

This structure type would be used on Segment JJ (Dam-Double Washington Route) in the city of St. Croix Falls.

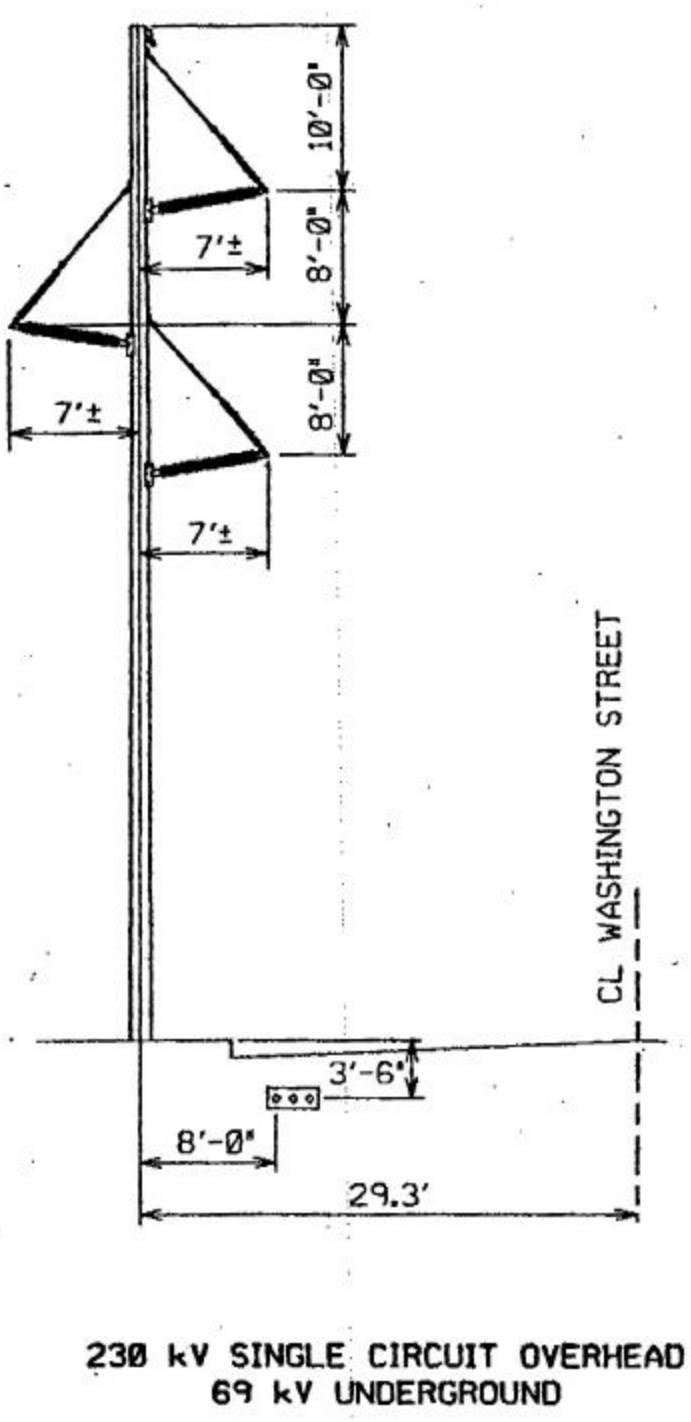
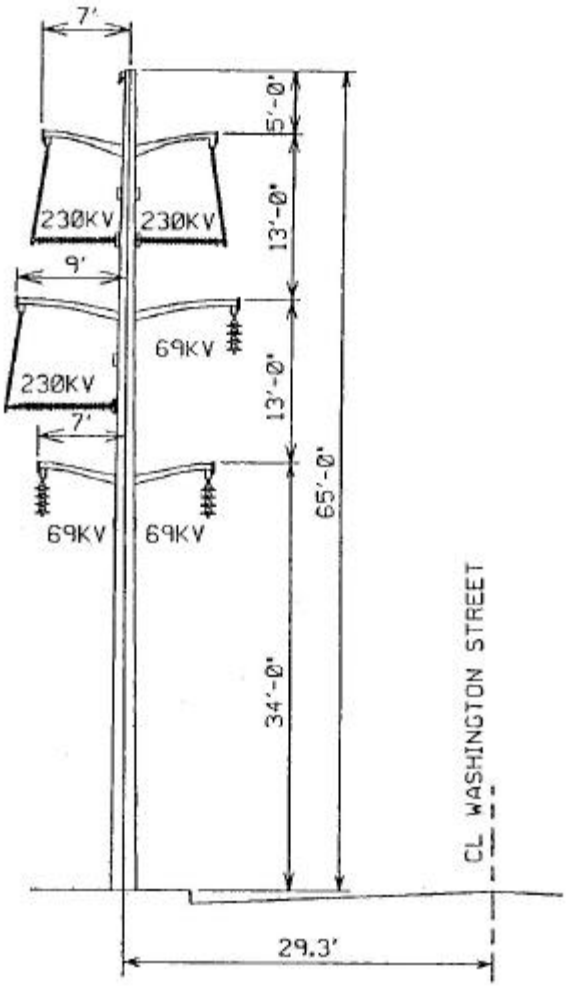


Figure D-3 Low-profile 230/69 kV I-string Double Circuit Structure

This structure would be used on Segments 101 C and 102 B (Dam-Louisiana-Washington Route).



PROPOSED
230/69kV DOUBLE CIRCUIT
FOUNDATION REQUIRED
USE EXISTING CENTERLINE
60' R/W WIDTH REQUIRED

Steel pole
Foundation 5-6' diameter
Pole base approximately 27"
Foundation height above grade-- 1 foot

Figure D-4 69 kV HLP with Distribution Underbuild

This structure type would be used on Segments JJ and JJ_2 (Dam-Louisiana-Washington Route).

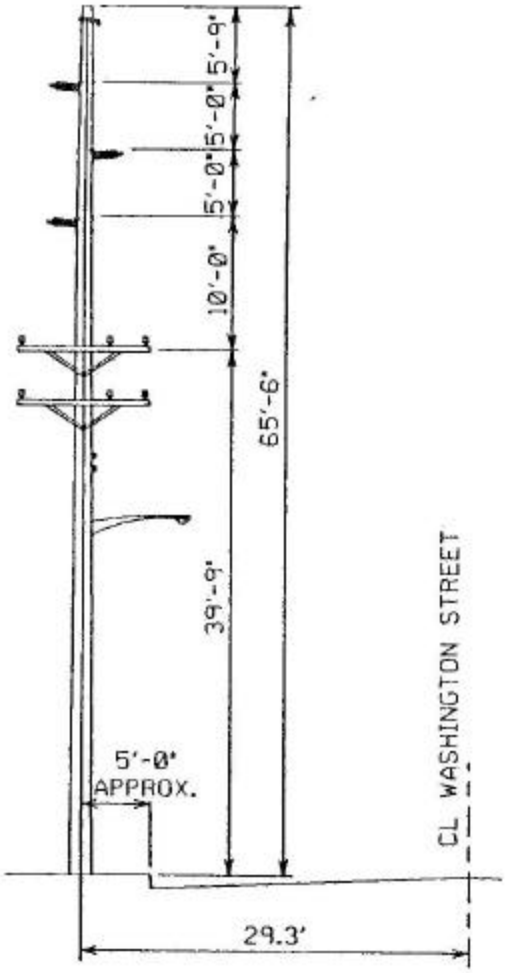


Figure D-5 Long-span 230 kV I-string

This structure type would be used on Segments OO, PP, and SS_2 (North-Washington Route) and on Segment II (South-Washington Route). Also on Segments 103 and UU (Split Route) and on Segment JJ_2 (Dam-Washington-Louisana Route).

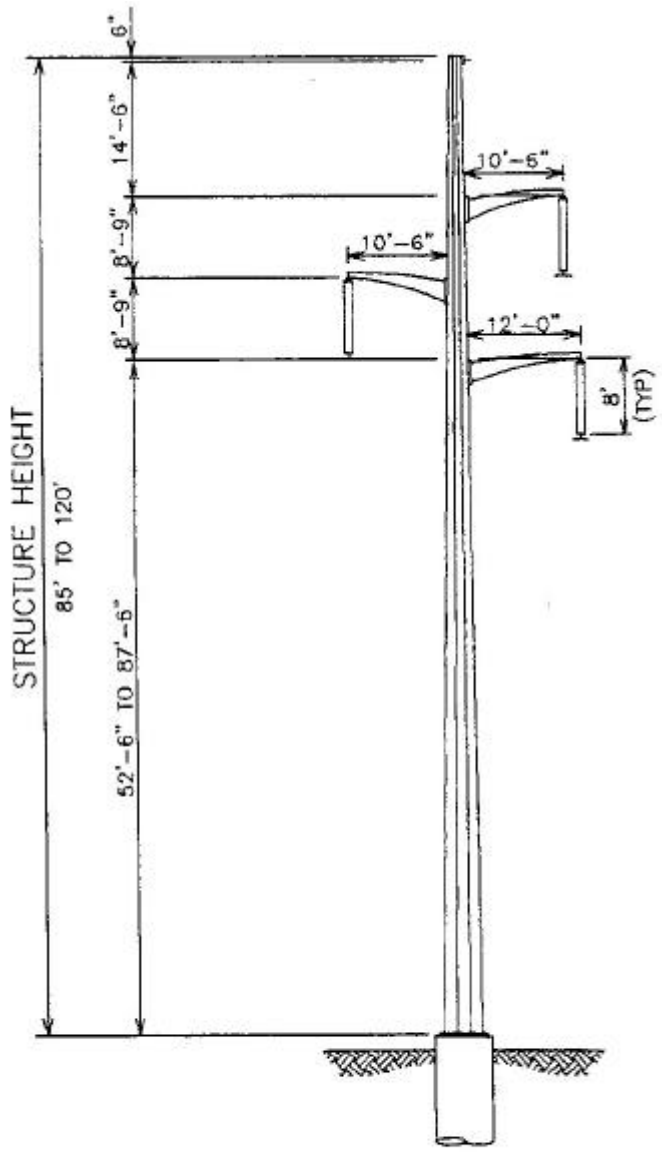
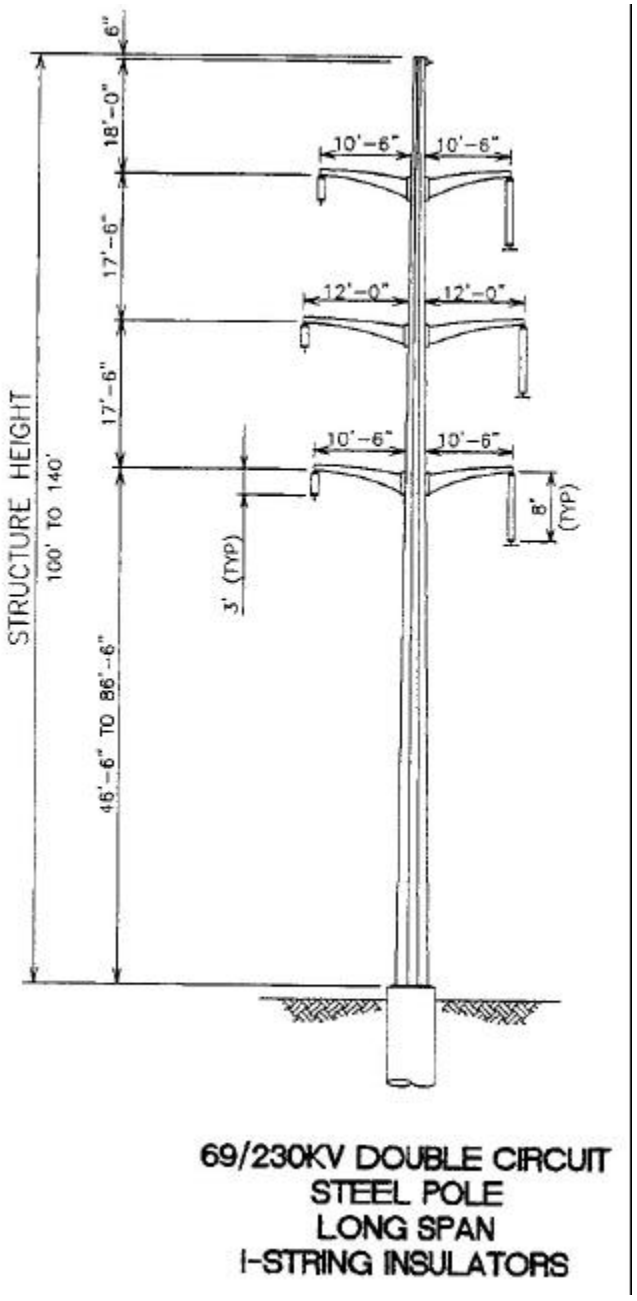


Figure D-6 Long-span 230/69 kV I-string Double Circuit Structure

This structure would be used on Segments JJ_2, KK_2 and SS_1 (Dam-Double Washington Route) and on Segments LL, MM, and XX (Double South Route). Also on Segments LL, VV, UU and WW (South-USH 8 Route) and Segment WW (Split Route).



Appendix E

Appendix E – Response to Comments on the Draft EIS

The Public Service Commission of Wisconsin (Commission) staff issued the draft Environmental Impact Statement (EIS) on the Chisago Electric Transmission Line Project in September 1998. Commission staff requested that written comments on the draft EIS be submitted by November 9, 1998. Over 100 written comments were received. Commission staff also noted the comments expressed at the two public information meetings held in the project area in Minnesota and Wisconsin in October 1998.

Some comments merely expressed opposition to the project. Some comments suggested extending the scope of an issue and would have required extensive study. Commission staff could not undertake these studies because of the press of time or questions about the usefulness of these studies for the purposes of the EIS. Some comments prompted further investigation of some issues or requested the addition of more information on some issues. Some of these comments were useful in identifying omissions and correcting drafting errors in the final EIS. These comments have been addressed by making changes in the final EIS.

This appendix includes some of Commission staff's written responses to comments received. Because it was not possible to respond to every comment, responses are grouped by issue. Because of the large numbers of comments received, it was not possible to reproduce them all in the final EIS. However, copies of the written comments received are available for review at the Commission's offices. The full text of any comments received from state and federal agencies involved in review of the proposed projects have been included. A list of people who provided written or phone comments is included after the written responses.

Commission staff carefully considered all of the comments on the draft EIS. These comments helped make the final EIS a better document for use by the Commission in making its decision.

Following are the comments received from state and federal agencies and staffs' written responses to the categorized comments:

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
George E. Meyer, Secretary

810 W. Maple Street
Spooner, Wi. 54801
TELEPHONE 715-635-2101
FAX 715-635-4260
TDD 715-635-4001

November 3, 1998

Udaivir S. Sirohi
Public Service Commission
P.O. Box 7854
Madison, Wisconsin 53707-7854

RE: Chisago Electric Transmission Line Project
Draft Environmental Impact Statement
PSC Dockets 1515-CE-102/4220-CE-155

Dear Mr. Sirohi:

We have reviewed the Draft Environmental Impact Statement for the above referenced project. We have provided comments for various sections to more fully describe resource concerns.

Chapter Two -Solutions for Transmission Problems - Page 24, The Regional Transmission Study of 1998-
The Final EIS must take into account the overall future power needs that are suggested in the regional study. Proposals that solve the long term power problems are important items to discuss in this EIS. The current proposal addresses immediate power needs but the environmental losses that would occur from additional proposals could be lessened by longer range planning and projects designs. The EIS should not be considered complete until it addresses the cumulative environmental losses associated with repeated smaller projects, compared to larger projects which would solve the longer term power needs while minimizing overall environmental impacts.

Proposed River Crossings - Location and Designs -General Environmental Characteristics of the St. Croix River Valley in the Proposed Project Area- page 48, paragraph 3- The St. Croix Falls Interlink Bike Trail was not included in this description of trails. This is a paved trail that travels from the Polk County Information Center to the entrance of Interstate Park.

Proposed River Crossings - Location and Designs -The North Crossing - Specific Environmental Characteristics-
New utility corridors are not generally considered yet all of the alternatives being considered have potential environmental impacts. At the south crossing these include impacts to state park property - aesthetics and use conflict issues, impacts to endangered/threatened species of mussels and fish, and impacts to a national scenic riverway. At the dam crossing impacts to the river, residences, fish hatchery and campground.

Riverway and wetland impacts described for the north crossing could be minimized through a directional boring of the river. Methods which would minimize impacts should be described in this section. The concerns regarding endangered/threatened mussels would not apply for this location. Transition structures placed above the river's steep hillsides would, to a large degree, reduce the visual impacts to the riverway.

Within the utility easement additional crossing locations may be possible. A range of potential crossing areas within the easement area could be analyzed to minimize overall environmental impacts. Future applications to increase transmission capacity or add additional utility lines could be controlled through written agreements with the utilities.

Proposed River Crossings - Location and Designs -The South Crossing - Specific Environmental Characteristics

Land ownership - The statement regarding land ownership abutting the river is incorrect. Both the DNR and a private landowner own land immediately abutting the river at the proposed location.

Interstate State Park- The area mentioned on page 56 as a peninsula that extends into the St. Croix river, and the specific site for the transmission line crossing is designated as a state natural area, known as the "Interstate Lowland Forest"

As stated in your DEIS a overhead line would be inconsistent with park management objectives as it would greatly affect visitor experiences within the park. Underground lines would avoid this problem if kept outside of the river viewshed or park property, but as stated on page 57, such underground lines could adversely affect rare mussel species located in the St. Croix River.

All proposed crossing alternatives at this location would have the potential to be inconsistent with department objectives related to park management and protection or endangered /threatened species. The statement on page 56, paragraph 4, regarding overhead structures states that placing "overhead structures or transition stations on or near the shoreline may be unacceptable"... to Interstate Park managers. This should be changed to read "are unacceptable". Any proposal at this location would, at a minimum, require undergrounding and distancing transition stations out of the riverway valley (on the Wisconsin side) and all Interstate Park property. This is not to say undergrounding is recommended, as impacts associated with directional boring, could affect a variety of rare mussels located in the river. If a proposal to directionally drill at this location High Voltage Extruded Dielectric cable would be the appropriate choice to minimize impacts.

Chapter 6 - Project Route Alternatives in Wisconsin - The St. Croix Sector - Route Alternatives

Dam - Louisiana - Washington Route - As proposed, overhead 69 kv transmission lines would be the least disruptive to DNR hatchery and the least disruptive overhead choice for Interstate State Park. Specific plans would need to be reviewed for any additional lines within proximity of the park entrance or proposed campground areas. Overhead transmission lines are not compatible with campground areas or park entrance areas. Several remedies are suggested in your DEIS that could be considered if this route option was selected. We would encourage options to consolidate existing and proposed lines to locations that would not be in the park entrance or campground areas.

Dam - Washington - Louisiana Route- The DNR Fish Hatchery in St. Croix Falls, which includes a small park and camping area, is located immediately south of the area where structures would need to be placed for a overhead river crossing, and has current transmission lines passing directly over two units of fish rearing raceways of the hatchery. Three immediate concerns are: 1) Increased voltage, discussed for some of the transmission line options, would pass through the hatchery property and could impact the fish propagation and rearing operations. 2) Placement of overhead or underground structures could impact the complex system of underground water supply pipes that are critical to the hatchery operation. 3) Human health concerns for all employees, visitors and campers at campsites adjacent to the hatchery. These points of concern are discussed below.

1) Impacts to trout production, associated with placing higher voltage lines across the state fish hatchery, are unknown. The risk associated with siting this transmission line option are significant because this hatchery is used as the primary Brook and Brown trout broodstock station, which spawns adults, incubates eggs, hatches sac fry, and rears production and broodstock trout. These fish are a significant part of the statewide coldwater fish management annual objectives. Losses of any of the above mentioned stages of fish development would be a significant detriment to the statewide fish management plan. The final EIS should include information on the impacts of placing this type of transmission lines close to a salmonid fish raising facility.

2) The St. Croix Fish Hatchery's water source is derived from an underground water source, and is delivered through water collection, water transport, and water discharge lines, which are located on the hatchery grounds, adjacent state park lands, state owned lands located east of STH 87, from south of the Dairy Queen property to the

Jor Gas property. The hatchery also has water easements with a number of persons/ businesses in that same area. Hillside spring flows could be interrupted by construction, and these areas contain unstable soils. All of these locations are highly sensitive to any disruptions, such as digging, associated with construction of underground transmission lines, or towers, and associated support structures for overhead lines.

3) Concerns also include the effects of these transmission lines upon employees at the hatchery, the 10,000 + visitors to the facility, the hatchery manager and family, who are required to reside in the provided state residence, and the numerous wildlife species that reside on the undeveloped portions of the hatchery/park property.

Dam - Double Washington route - Concerns are similar to those described for Dam - Louisiana-Washington alternative.

North - Washington route - As shown in the DEIS the crossing would proceed east just south of CTH I . At this location forest resource losses might be minimized by avoiding the side slopes which lead to Big Rock creek. Were impacts of locating the line closer to the road, where it would not interfere with existing homes, considered as a option? The natural forest cover along the eastern part of CTH I has already been cleared through development of the highway. Impacts along this section would be minimal compared to the location shown in the DEIS. The most significant section that would be impacted would be the western section of CTH I as it approaches the St. Croix river. At this location the forest is more dense than farther west but also breaks into some open areas farm areas.

The Apple River Sector - Route Alternatives-

General Comment - All route options cross Balsam Branch at either of two locations. Waterfowl use these areas and impacts would be similar at each location. Specific crossing locations could be developed if either of these locations became the selected alternative.

Double South route - This route would cross or be adjacent to Apple River Flowage, the D. D. Kennedy Environmental Area and Garfield Recreation Areas, as well as smaller waterways, wetlands, and other resources. These areas support a variety of waterfowl, wildlife, and in part have been developed as outdoor recreational use areas by the county. As this is primarily a cross-country route the diversity of natural resources is greater than for land which has been previously developed, such as road corridors.

South - USH 8 route - The eastern portion of this route travels in the same locations as the Double South route. The western portion would have resource concerns similar to the western section of the Split route

Split route - Most of this route uses established roadway corridors. Disturbance to forest cover has already occurred for a portion of what would be required for this route. Additional clearing would widen the opening but cumulatively would be less that the losses that would be incurred for the other routes. The Deer Lake area would need to receive special consideration to minimize impacts.

Appendix B - Environmental Aspects of the System Alternative-

A number of areas described in this appendix are important natural resource areas. Specific routes for transmission lines would need further study to determine if there are any realistic locations that would not impact these areas. Some route options may need significant alterations to the "reference centerline" so as to avoid important natural resource properties. Many other resource concerns would also need to be described and evaluated to fairly compare the environmental impacts of such proposals to the current Chisago proposal.

Rock Creek to Apple River- St. Croix River Crossing - Overhead transmission line options across the St. Croix would be inconsistent with management objectives of Governor Knowles State Forest. Aesthetic impacts were considered for the previous transmission line crossing of the St. Croix River by burying the current transmission line. Within the Governor Knowles State Forest overhead structures were partially hidden by placing them away from the highway within the viewshed of the highway portion of the state forest and the national scenic riverway. The current line required cutting a corridor through State Forest property for transmission purposes. Installing

larger overhead lines, with wider right of way openings, and increased visual disturbance, would not be supported as they would result in considerable additional impact to the aesthetics of the Governor Knowles State Forest. As stated in your document this is a highly controversial issue. Concerned citizens and Department personnel agreed to only the existing line and corridor, not to additional lines and impacts caused by additional proposals.

Rock Creek to Apple River - General Land Use Impacts- The most significant area of concern is the Fish Lake Wildlife Area, where any line adjacent to the property along STH 48 would not be recommended. Additionally no information was presented for the Rock Creek - Washco alternative mentioned in the MEQB report. Beaver Brook Wildlife Area is located along this route, and similarly would require significant changes if such an alternative was to be considered.

King to Apple River and Red Rock to Crystal Cave - We have concerns similar to those listed in your DEIS.

Arrowhead to Arpin - We have concerns similar to those listed in your DEIS. The pipeline listed here is a oil pipeline.

We appreciate this opportunity to comment on the DEIS. If you have any questions regarding our comments please call me at 715-635-4227.

Sincerely,

William L. Gantz
Environmental Review Coordinator

cc:

Lawrence Wolfe - RUS
Anthony Anderson - National Park Service
Janet Smith - U.S. Fish & Wildlife Service- Green Bay
Dan Seemon - U.S. Army Corps of Engineers
Randy Ferrin - St. Croix National Scenic Riverway
John Hynes - MEQB
Mike Giles - Governor Knowles State Forest- Grantsburg
Jim Harrison - Minnesota- Wisconsin Boundary Area Commission
Jeff Krueger - Interstate Park
Terry Moe - La Crosse
Tom Lovejoy - Eau Claire
Pam Rasmussen -NSP
Jeffrey Tabat -DNR Fish Hatchery - St. Croix Falls
Steve Ugoretz - SS/6
Phil Anderson - Cumberland
Kevin Morgan - Barron
Bruce Moss - Spooner
John Gozdzialski - Spooner

United States Department of the Interior

NATIONAL PARK SERVICE
St. Croix National Scenic Riverway
401 Hamilton Street
P O. Box 708
St. Croix Falls, Wisconsin 54024-0708

IN REPLY REFER TO:

November 4, 1998

L7615(SACN)

RECEIVED
NOV 16 1998
Electric Division

Mr. Udaivir S. Sirohi
Wisconsin Public Service Commission
610 North Whitney Way
Post Office Box 7854
Madison, Wisconsin 53707-7854

Dear Mr. Sirohi:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the proposed Chisago Electric Transmission Line Project, Dockets 1515-CE-1025/4220-CE-155. The applicants are Northern States Power Company-Wisconsin, and Dairyland Power Cooperative. We are responding with these comments under the authority of the National Wild and Scenic Rivers Act.

The St. Croix River and its major tributary, the Namekagon River, are one of the original components of the National Wild and Scenic Rivers System as enabled by the Wild and Scenic Rivers Act of 1968. The lower river, from Taylors Falls/St. Croix Falls was added to the system in 1972. The National Park Service manages the Upper St. Croix Riverway and Lower St. Croix Riverway as a single unit. We are charged with protecting the scenic, biological, geological, and recreational qualities of the riverway, which were identified in the act as "outstandingly remarkable values" that led to designation as a nationally significant riverway.

We have participated in the discussions concerning the Chisago Project for a number of years. We have been and remain concerned about the degradation of scenic and other values that would occur if the project were implemented, especially as an overhead crossing of the riverway. We also have concerns about trenching due to potential environmental degradation, such as sedimentation during construction, disturbance of mussel beds, etc. The DEIS does not resolve our concerns.

In any of the alternatives, a crossing using horizontal directional drilling techniques would be preferable provided that 1) there are no adverse environmental impacts, 2) no towers or lines approaching the crossing are within line of sight from the river, and 3) mitigation of any resource degradation or damage due to construction is undertaken and completed.

To protect riverway resources and values, the National Park Service has adopted a policy of consolidating new and replacement utilities and bridges in existing crossings. This policy is articulated in the new general management plan for the Upper St. Croix Riverway, approved on July 16, 1998.

The plan states:

> "Because there are already numerous river crossings, the National Park Service will discourage new crossings for bridges, roads, trails, railroads, and utility lines. The replacement of bridges and other utility crossings will be permitted only if they meet the requirements of the Wild and Scenic Rivers Act. The National Park Service will work to consolidate crossings wherever possible, place new bridges and utilities in existing corridors, and find solutions that will not impact Riverway resources."

The National Park Service continues to work with the states of Wisconsin and Minnesota to develop a cooperative management plan for the lower St. Croix, which has the same purpose as the general management

plan for the upper riverway. The preferred alternative makes a recommendation nearly identical to the management objective in the upper riverway plan.

The proposed Taylors Falls/ St. Croix Falls crossing identifies three alignments.

The southern crossing at the Dalles is through an existing corridor that does not currently include an overhead transmission line. We would oppose a new overhead crossing in this corridor because of the impact upon the outstandingly remarkable scenic values at this location. The only alternative that would be acceptable here would be a crossing using horizontal directional drilling and installed in a manner that provides no adverse environmental impacts including lines, towers, buildings, roads or road cuts, or similar disturbances to the scenery within line of sight of the river.

The central crossing is an existing transmission line corridor, and as such, fits our policy of consolidating crossings in existing corridors. However, we are very concerned about the impacts an overhead transmission line would have on our neighbors in St. Croix Falls and Taylors Falls. An additional and /or larger overhead transmission line would have a visual impact upon the natural and historic landscape of this section of riverway.

The northern crossing would constitute a new corridor. We have stated previously that only existing corridors be used and are therefore opposed to this alternative.

Alternate routes presented by the Minnesota Environmental Quality Board and the Citizens Task Force have merit and should be further explored by the applicant. These include the King Plant, Rush City at Highway 70, and the Arrowhead-Arpin option.

Overhead transmission lines already exist near the NSP King Plant in Bayport. We feel that this alternative has not been given adequate consideration. This alternative should be subjected to an in-depth analysis for further review.

A 69-kilovolt transmission line installed using directional drilling already exists at the Highway 70 Bridge near Rush City, Minnesota. In addition this bridge was designed to be able to carry a transmission line. We feel that these alternatives have not been given adequate consideration and should be subjected to an in-depth analysis for further review.

The Arrowhead-Arpin option also has not been given adequate consideration and should be subjected to analysis for further review.

We also have responsibilities under other federal laws, executive orders, regulations, and policies. As those responsibilities are exercised, we may have further concerns that must be resolved in the planning and implementation of the Chisago Project.

We appreciate the opportunity to review and comment on the DEIS and trust that you will fully consider our comments. We are committed to finding a solution that fills public utility needs while protecting the nationally significant values and resources of the St. Croix National Scenic Riverway.

Sincerely,

Anthony L. Andersen
Superintendent

Barb,
Please copy & distribute.
Udaivir
11-24-98

State Historical Society of Wisconsin
816 State Street ♦ Madison, Wisconsin 53706-1488 ♦ 608/264-6400 ♦ Fax: 264-6504

Division of Historic Preservation
608/264-6500

November 20, 1998

Mr. Udaivir S. Sirohi
Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

IN REPLY PLEASE REFER TO
SHSW COMPLIANCE CASE #96-0672/PK

RE: Dairyland Power Company/Northern State Power Company
230kV Chisago To Apple River Power Line Project
ID: 4420-CE-115

Dear Mr. Sirohi:

We are reviewing the above-referenced project as required for compliance with Section 106 of the National Historic Preservation Act and 36 CFR Part 800: Protection of Historic Properties, the regulations of the Advisory Council on Historic Preservation governing the Section 106 review process.

We recommend that all areas of proposed new ground disturbing activity be surveyed by a qualified archeologist to locate and evaluate the significance of any archeological sites that may be present. When the survey has been completed, please provide two copies of the archeologist's report for our review and comment. Please ensure that the archeologist's report is accompanied by the SHSW Compliance Case number **(SHSW: #96-0672/PK)**.

The possibility exists that standing structures which may be eligible for the National Register of Historic Places will be affected by this project. We recommend that a qualified architectural historian (pursuant to 36 CFR 61) survey the area of potential effect (APE) and document their findings, following enclosed report specifications. Please submit two copies of the report through the appropriate channels to this office for review and comment, pursuant to 36 CFR 800.4. Please ensure that these reports are also accompanied by the SHSW Compliance Case number noted above.

If there are any questions concerning this matter, please contact me at (608) 264-6507.

Sincerely,

Sherman J. Banker
Compliance Archeologist

SJB/DJD/djd

cc w/o Encl: Mr. Lawrence Wolfe, USDA-RUS-E&ES

Response to Comments -- Chisago EIS

1. Several people expressed concern about the proximity of a 230 or 69 V line to the elementary school and the Good Samaritan Nursing home on Louisiana Street. The potential effect of EMF on heart defibrillators (pace makers) was also raised.

Response: If the 230 kV or 69 kV line were routed along Louisiana Street, the line would be placed underground using SCFF or HVED technology. The estimated magnetic field levels of an underground 230 or 69 kV line would decrease to about 1 mG or less within 100 feet of the line. While the magnetic field levels in the street at the centerline would be comparable to those of an overhead line, the estimated magnetic fields would decrease, within 50 to100 feet from the line, to approximately the same levels measured in the average home. Thus, it would not be expected that the EMF produced by a transmission line on Louisiana Street would affect heart devices of residents at the Good Samaritan Nursing Home or the health of children in the school.

2. Mr. Thomas Engel noted that Jerusalem Pond located adjacent to Blandings Wood Road was not discussed in the draft EIS nor were potential adverse effects of boring or trenching the 69 or 230 kV line in this vicinity.

Response: Additional information has been added to the discussions on the Dam-Louisana Route and the Dam-Washington Route to reflect the presence of Jerusalem Pond.

3. Several persons, including Debra Points, Gary and Carolyn Lumsden, Robert and Mary George provided additional information about the presence of trumpeter swans in the project area.

Response: These comments were very useful. Information about the location of swans, their habits when migrating through the project area and the potential for adverse impacts has been added to Chapters 5 and 6.

4. Several homeowners that reside on Birchwood Lane on the eastern shore of the Apple River flowage questioned the applicants proposal to move the existing power line crossing about 0.25 mile north of the existing crossing location of the 69 kV line.

Response: These residents state that the flowage is wider at the location of the proposed crossing than at the existing crossing and that the new lines would be more visible and pose a greater hazard for waterfowl, swans

and geese that migrate through and nest on the flowage. Concerns were also raised that moving the crossing 0.25 mile north and routing the 69 kV or 230/69 kV lines south on STH 46 to rejoin the existing 69 kV line would result in residents being surrounded on three sides by transmission lines.

The new crossing was proposed by the applicants to minimize the impact of the line(s) on the existing residences. The existing 69 kV passes very close to several residences. The proposed crossing passes through a pine plantation north of Birchwood Lane. If this route is selected, the applicants would be required to work with the residents on Birchwood Lane to minimize their concerns about the visibility of the line and with the DNR to reduce the potential for bird/wire collisions. Minor modifications in line design or route could help to mitigate these impacts.

5. At least 21 people or organizations commented about locating the transmission line(s) along USH 8; most comments were from residents near Deer Lake. The comments characterize the area as environmentally beautiful and having high quality lakes and wetlands, a rural lifestyle, valuable property, and a community actively working to preserve sensitive habitat. Also included were comments that describe USH 8 as: 1) a corridor targeted for residential and commercial growth; 2) a main artery with a huge amount of traffic, making it dangerous and in need of upgrades (widening); and 3) a very busy and populated area that is rapidly becoming the commercial center of Polk County.

Response: All those who commented argued against locating the power line along USH 8. They suggest putting the line in a less populated and less environmentally beautiful area. Staff added Segment 103 and the Split Route for consideration to provide a choice that would not further impact the D. D. Kennedy Environmental Park and the Garfield Recreation Area, two areas designated by Polk County as deserving special consideration. (An existing 69 kV transmission line already passes through these sites). Also, many public comments from the RUS scoping meeting in June 1996 suggested the use of USH 8 as a corridor for the new 230 kV line rather than increasing the existing impacts in the D.D. Kennedy and Garfield Parks.

Local input on proposed route alternatives is very useful when making routing decisions to mitigate potential impacts. Most public input on this proposed project has been directed toward placing the line in another location far removed from the project area. While a thorough evaluation of system alternatives is necessary, assumptions should not be readily made that these system alternatives would solve the

electrical problems as well, be less environmentally damaging, or pass through communities that would not be equally concerned.

Finding route options that minimize the overall impact of a line or provide choices that mitigate some impacts is an important aspect of evaluating the applicants proposal. The route alternatives proposed for the Apple River are an attempt to provide these choices. A line located in a less populated area (rural farmland, forest, or prairie) avoids more people in homes, cars, and trucks but could create a greater incremental impact on aesthetics, valuable natural resources, habitat, and perceived property values. A line located along an existing transportation corridor such as USH 8 would be closer to more homes, cars, trucks, and businesses but may have a smaller incremental impact on aesthetics, natural resource habitat, and perceived property values.

If there are specific sites along USH 8 that are particularly sensitive or where local groups have done restoration work, those sites could probably be avoided through modifications in line location or design. The Commission would need to know the exact location of these areas in order to enforce mitigation actions that prevent or minimize damage (e.g., which side of the road to place the line, the exact placement or method of pole placement to protect sensitive habitat).

Concerns about property values are not unique to the Deer Lake area. The monetary value of property may be higher adjacent to the lake but the type and magnitude of possible impacts would be similar in other areas. A more detailed reply to concerns about property can be found elsewhere in this section.

6. Several persons commented about the potential for noise to emanate from the new power line.

Response: Power lines do not usually make noise. However, some people have reported that vibrations are sometimes heard under particular wind conditions and for particular lines. In foggy weather conditions, power lines can cause a subtle crackling sound because a little of the electricity ionizes the moist air near the wires. Ionization in foggy conditions can also cause corona, which is a luminous blue discharge of light, usually where the wires connect to the insulators. Ionization occurs most often in high-voltage 345 kV lines, less often in lower voltage lines

7. Some comments (Eric and Mary Huttner, NSP) expressed a desire for more information on underground transmission technologies-

specifically the expected life of underground power lines and heat dissipation.

Response: For accounting purposes the PSC uses 37 years as the expected life for underground conductors and 32 years for overhead lines in northern Wisconsin. According to Power Delivery Consultants, Inc., depending on the type of underground cable, the failure rate for underground cables varies from one failure per year for each 400 3-phase circuit miles to one failure per year for 500 miles. Therefore, for each mile of underground line the chances of a cable failure are 1:400 or once every 400 years.

Some additional information about installation of underground cable has been added to Chapter 5. Trenched cable will be 3 to 4 feet deep and cable installed by guided boring under the river would be 40 feet below the surface.

8. Several comments stated that the information in the draft EIS regarding the potential effects of transmission lines on property values was not well documented. Meg Luhrs provided staff with a large amount of information from local residents and business owners gathered over the past year.

Response: Commission staff has compiled numerous research studies and trade articles on the effects of transmission lines on property values. This information includes over 30 articles dating from 1987 through 1997. Among the articles are survey or attitudinal studies, valuation studies involving the comparison of similar properties, and studies using multiple regression analyses with large sample sizes and a high number of variables. The first two methodologies, survey or attitudinal studies and valuation studies, were popular in the 1970's and 80's, but were found to be not especially useful or accurate in assessing property value impacts. In recent years, studies using multiple regression analysis have provided better information that can be used to assess the effects of power lines on property values (Hamilton and Schwann 1995).

Primarily, two factors, fear of adverse health effects and aesthetic issues are the reasons for a potential drop in residential property values. While no conclusive evidence of the effects of EMF on health exists, it is recognized that people's concerns about this issue can influence their decisions related to purchase of property. The unsightliness of transmission line structure and wires can also negatively affect the perceived aesthetic quality of property. These conclusions have been borne out in court cases and legal opinions.

The research shows, however, that proximity or nearness to the line or the ROW is an important determinant where property value effects have been identified. Homes not directly adjacent to the ROW or beyond 200 feet from the ROW were affected to a much lesser degree than those abutting the line or ROW (Kung and Seagle 1992, Kinnard 1992). Other studies by Hamilton and Schwann (1995) also show that proximity to the transmission towers is an important factor and that increasing the distance of the towers from homes to 100 meters or more lessens the adverse affect on property values.

Property value decreases for properties adjacent to a transmission line range from 5 to 9 percent (Colwell 1990, Ignelszi and Priestly 1991), 2 to 5 percent (Kung and Seagle 1992, Kinnard 1992), and 9 to 14 percent (Steigerwaldt Land Services 1994). (The Steigerwaldt results are from a paired comparison of lots within a new wooded subdivision along the Wisconsin River. The study did not take into account differences in forest quality or cover on the lots.)

In a small number of studies and in anecdotal evidence gathered in the review of many transmission line projects, some transmission lines appear to have no effect or a small positive effect on property values. This is primarily due to the additional green space or buffer that ROWs may provide. On lands used primarily for recreational purposes, the ROW can provide access for hunting, walking, snowmobiling, or cross-country skiing.

Nearly all of the studies agree that other amenties, such as proximity to schools or jobs, lot size, or square footage of a home, have a greater effect on property values.

Kinnard and Dickey (1995) report that no studies of market price reductions of commercial, retail, and/or industrial properties have come to their attention.

9. Concerns about the effect of the 230 kV transmission line on tourism in the area have also been raised in several comments.

Response: It is not possible to predict what, if any, effect a new high-voltage line would have on tourism in the St. Croix Valley. Many mitigation strategies, including placing the line underground, could be used to minimize the visual and physical presence of the line. In St. Croix Falls the dam, hydroelectric plant and existing wires across the river have been in place for many years. A new transmission line on low-profile structures across the river below the dam, could be viewed as an incremental impact in an existing energy-related setting. The use of

taller, long-spanning steel structures could be limited to route segments outside of the river valley.

The presence of the line would not be expected to change the nature of any existing or future industrial, commercial, or retail development including tourism. The future expansion and focus of customer service-related businesses would likely have a far greater impact on area tourism than an electric transmission line, especially if the visual impact of the line can be mitigated through the use of the proposed line designs.

10. Some comments requested more information about the effects of Targeted Area Planning (TAP) on the need for the Chisago Project.

Response: More information about TAP has been added to Chapter 2.

11. Several people expressed concerns about stray voltage from the proposed line.

Response: Stray voltage is a small voltage between two contact points (generally grounded metal objects). This is a concern on dairy farms because cows touching the two contact points may sense a small current. In some instances, behavioral changes may occur in the cows.

The utilities, the Department of Agriculture, Trade, and Consumer Protection, and the PSC have programs to identify and solve stray voltage problems. In nearly all cases, these problems are due to distribution lines or the wiring on a farm. Transmission lines are seldom the cause of stray voltage problems.

12. A comment from the manager of the Department of Natural Resources fish hatchery in St. Croix Falls expressed concerns about the effects of magnetic fields on fish production and the health of employees and visitors to the hatchery and a nearby campground. The existing 69 kV line passes directly over two fish-rearing tanks.

Response: An extensive literature search did not reveal any studies of the effects of EMF on fish behavior or reproduction. Additional information regarding the estimated magnetic fields produced by a single circuit overhead 230 kV line on low-profile structures and an underground 230 kV line is in Chapter 4 along with a more detailed discussion of studies done to date on the effects of EMF on human health.

13. Many comments expressed the view that there is no need for the proposed project.

Response: Information was revised and added to Chapter 1 of the EIS to clarify that the need and timing for the project is to provide reliable electric service to customers in northwestern Wisconsin and east-central Minnesota. The added transfer capability that is incidentally provided by the project can be used to increase the reliability of the Minnesota-Iowa-Wisconsin-Illinois region, but this was not the reason the project was proposed. Larger transmission projects would be necessary to meet the higher regional transfer capability goals of the regional transmission study.

14. Several verbal comments made at the October 1998 meetings on the draft EIS related to using existing generation in northern Wisconsin to eliminate the need for the proposed project.

Response: Ideally, it should not be necessary to operate generation to ensure the transmission system operates properly. Using generation this way is referred to as "an operating guide". When an operating guide such as this is used, the electric system is more likely to experience an outage and the cost for electricity is higher. Generation units have higher outage rates than transmission lines because units have more mechanical parts that can malfunction than a line. The use of generation in lieu of new transmission puts customers at greater risk of a service interruption. Generation that operates solely to allow the transmission system to operate properly, when other lower-cost generation would otherwise have been operated, incurs higher costs that are passed on to customers. An operating guide is a stop-gap measure until transmission improvements are made. For example, generation in northern Wisconsin has been operated to support the area's transmission system for the last several years. After construction of the new Stone Lake-Bay Front line, it will no longer be necessary to operate the generation this way.

15. Several written comments stated a belief that the purpose of the proposed project is to address power needs in eastern Wisconsin and northern Illinois, and not for customers in northwestern Wisconsin.

Response: Newsworthy events related to electric system reliability in the Midwest have occurred recently. Electric reliability problems occurred in eastern Wisconsin and northern Illinois in 1997, due to multiple nuclear units being simultaneously out of service. To find ways to prevent future problems, a preliminary regional transmission study was performed in 1998 and is in the process of being refined. Information has been added in Chapter 1 that clarifies that the project is not proposed for the power needs of eastern Wisconsin or northern Illinois, and explains how the proposed project is related to the regional transmission study.

16. Several people commented that an Arrowhead alternative was better than the proposed project, for different reasons. One comment stated that the Arrowhead alternative would pay for itself three times over.

Response: The EIS provides a detailed explanation of all the analyses that have been performed (electrical, economic, environmental) to determine which system alternative should be built. Information was added to the EIS about the analysis for the regional transmission study, and an explanation of how several of the study's options are related to the system alternatives analyzed in the past. None of the cost analyses indicate that the Arrowhead alternative would pay for itself; it has lower electrical losses relative to the other alternatives but its construction cost is considerably higher than the other alternatives resulting in higher overall cost.

17. Many people commented that regional needs should be considered. They asked for clarification about how the proposed project is related to the regional transmission study.

Response: Information was added to Chapter 1 about the origin of the regional transmission study. In Chapter 2, information was added about the various regional options, how the proposed project is factored into the study, and how the proposed project relates to the options in the study.

A list of people who provided written or phone comments, or spoke at the October meetings, follows:

Andrie, Patricia A.
Barott, Lois
Barott, Sally
Becker, Jay
Bethesda Cemetery Assn.
Big Rock Creek Farm
Blair, Vicky
Boyken, Mark E. MD
Braatz, Rosemarie Vezina
Brissett, Marilyn
Carlson, Dan and Colleen
Clark, Barbara
Clausing, Senator Alice
Cram, Barclay M
Creative Spirit, Chris Larson
Cunningham, Mike and Cheri
Deer Lake Conservancy
Department of Natural Resources
Dombrock, Donna
Duncanson, Lincoln and Ellen
Duxbury, Margaret M.
Edstrom, Jill
Engel, Tom
Everson, Kathleen
Faith, Kirsten
Fredrickson, Barbara
Gamache, Ronald
George, Robert and Mary
Gutzmer, Jack
Hallquist, JoAnn
Hallquist, Marguerite
Heinrich, Paul
Hipp, Lin
Hornsten, Diane and Andrew
Huttner, Elodie
Huttner, Eric and Mary
Johnson, Harold L.
Julik-Heine, Larry
Klug, Ronald
Kramer, Mrs. Dolores
Lagus, Arne
Larson, Kurt
Leedy, Don and Joan
Lindbom, Ramona and Ted
Linehan, James E. and Patricia E.
Luhrs, Margaret
Lumsden, Gary and Carolyn
Malchow, Jim
Martin, Tom
McElhone, Patrick

Continued

Mika, Tim

Minnesotans for an Energy-Efficient Environment

Mumm, Donna

Nelson, Bill and Renae

Nelson, Dave and Shirley

Nelson, Jeanne and James

Nelson, Robert and Margie

New Lagoon Campground Condominium

Northern States Power Company

Oberg, Mark

O Boyle, Roger

Osceola, Town of

Patten, William and Wilma

Petersson, Emelie

Points, Debra

Pope, Susan

Posch, David

Ray, Charly-Green Onion Resource

Remund, Fred and Sharon

Reynolds, Mary

Richey, Paula K.

Riebe, Margaret

Riegel, Dr. Fred and Dolores

Roberts, Walter

Roder, Raymond (Big Rock Creek)

St. Croix Economic Development Corporation

Sabrina, Amy

Sackett, Dr. Stephen & Jane

St. Croix Falls, City of

Sammond, Peter H.

Schultz, Lynn

Singerhouse, Barbara

Spotts, Richard

State Historical Society of Wisconsin

Swanson, Dean

Swanson, Hubert

Taylors Falls, City of

Testin, Laurie L.

Van Dyke, John and Jane

Wagstrom, Wallace and Jeanette

Walker, James L.

Ward, Amy

Wineinger, David M.D.

Wisconsin Electric Power Company

Young, Charles E.

Appendix F

Appendix F – Acronyms used in the Environmental Impact Statement

Acronym	Definition
ACES	Alliance for Clean Energy Systems
AIS	Agricultural Impact Statement
BER	Bureau of Endangered Resources
CCVT	Coupling capacitor voltage transformer
COE	Corps of Engineers
CE	Commonwealth Edison
CRVC	Concerned River Valley Citizens
DATCP	Department of Agriculture, Trade and Consumer Protection
DC	direct current
DEIS	Draft Environmental Impact Statement
DNR	Department of Natural Resources
DOT	Department of Transportation
DSM	Demand-side management
DPC	Dairyland Power Cooperative
EIA	Environmental Impact Assessment
EMF	Electromagnetic fields
EWU	Eastern Wisconsin Utilities
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
GWH	Gigawatt-hour
HDD	Horizontal Directional Drill
HPFF	High pressure fluid filled
HVED	High voltage extruded dielectric
IARC	International Agency for Research on Cancer
KV	Kilovolt
LOLE	Loss-of-load expectation
MAIN	Mid-America Interconnected Network, Inc.

Acronym	Definition
MAPP	Mid-Continent Area Power Pool
MDPS	Minnesota Department of Public Service
MEQB	Minnesota Environmental Quality Board
MG	Milligauss
MGE	Madison Gas and Electric Company
MPUC	Minnesota Public Utility Commission
MW	Megawatt
NIEHS	National Institute of Environmental Health Sciences
NSP	Northern States Power Company
NSPM	Northern States Power Company-Minnesota
NSPW	Northern States Power Company-Wisconsin
NWEC	Northwestern Wisconsin Electric Company
PV	Photovoltaic
RAPID	Research and Public Information Dissemination
ROW	right-of-way
RUS	Rural Utilities Service
SHSW	State Historical Society of Wisconsin
SCC	self-contained fluid-filled
TAP	Targeted Area Planning
WEPA	Wisconsin Environmental Policy Act
WEPCO	Wisconsin Electric Power Company
WP&L	Wisconsin Power and Light Company
WPPI	Wisconsin Public Power Incorporation SYSTEM
WPS	Wisconsin Public Service Corporation
WRAP	Wind Resource Assessment Project
WWU	Western Wisconsin Utilities
XLPE	Cross linked extruded dielectric